

Exhibit 6 to
ADS Security, L.P.'s
Motion for Attorneys' Fees



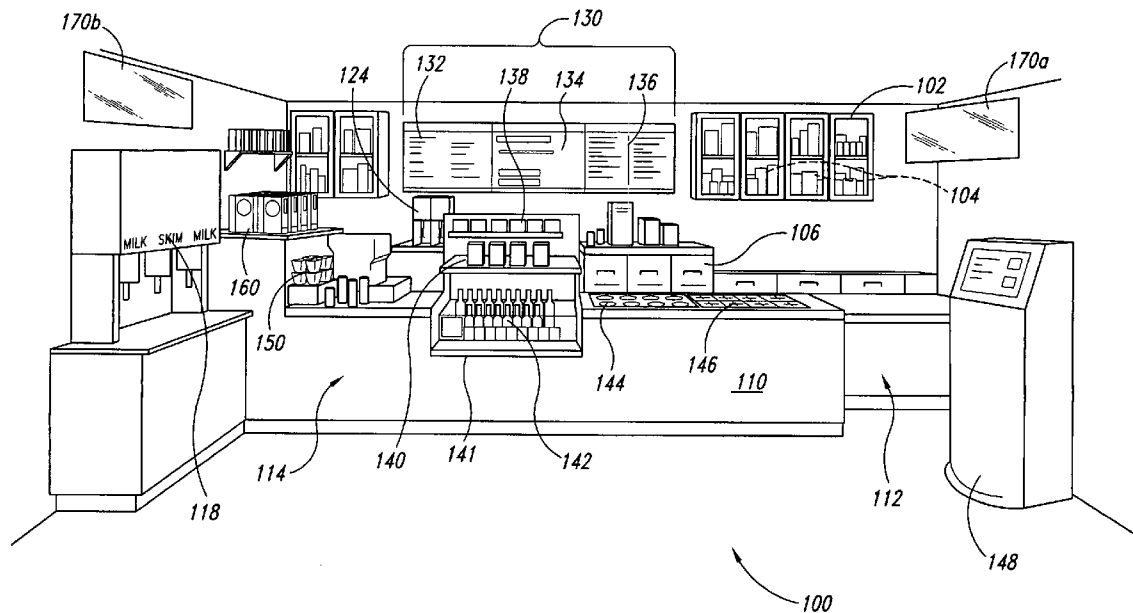
US 20050160005A1

(19) **United States**(12) **Patent Application Publication****Roth et al.**(10) **Pub. No.: US 2005/0160005 A1**(43) **Pub. Date: Jul. 21, 2005**(54) **METHODS AND SYSTEMS FOR PROVIDING FOOD, BEVERAGES, AND ASSOCIATED GOODS AND SERVICES IN A RETAIL ENVIRONMENT****Publication Classification**(51) **Int. Cl.⁷ G06F 17/60**(52) **U.S. Cl. 705/15**(76) **Inventors: David Roth, Chicago, IL (US); Rick Bacher, Chicago, IL (US)**(57) **ABSTRACT**

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SEATTLE, WA 98111-1247 (US)**(21) **Appl. No.: 11/078,686**(22) **Filed: Mar. 11, 2005****Related U.S. Application Data**(60) **Provisional application No. 60/604,504, filed on Aug. 24, 2004. Provisional application No. 60/565,984, filed on Apr. 28, 2004.**

Methods and systems for providing food, beverages, and associated goods and services are described herein. In one embodiment of the invention, a method for providing breakfast cereal in a quick-serve restaurant setting includes displaying multiple readily-recognizable, competitively-branded, breakfast cereal boxes in view of customers. The method further includes receiving a request from a customer for a first portion of a first one of the breakfast cereals and a second portion of a second one of the breakfast cereals. In response to receiving the request from the customer, the method additionally includes combining the first and second portions of the breakfast cereals together in a carry-out container and presenting the container to the customer in exchange for payment.



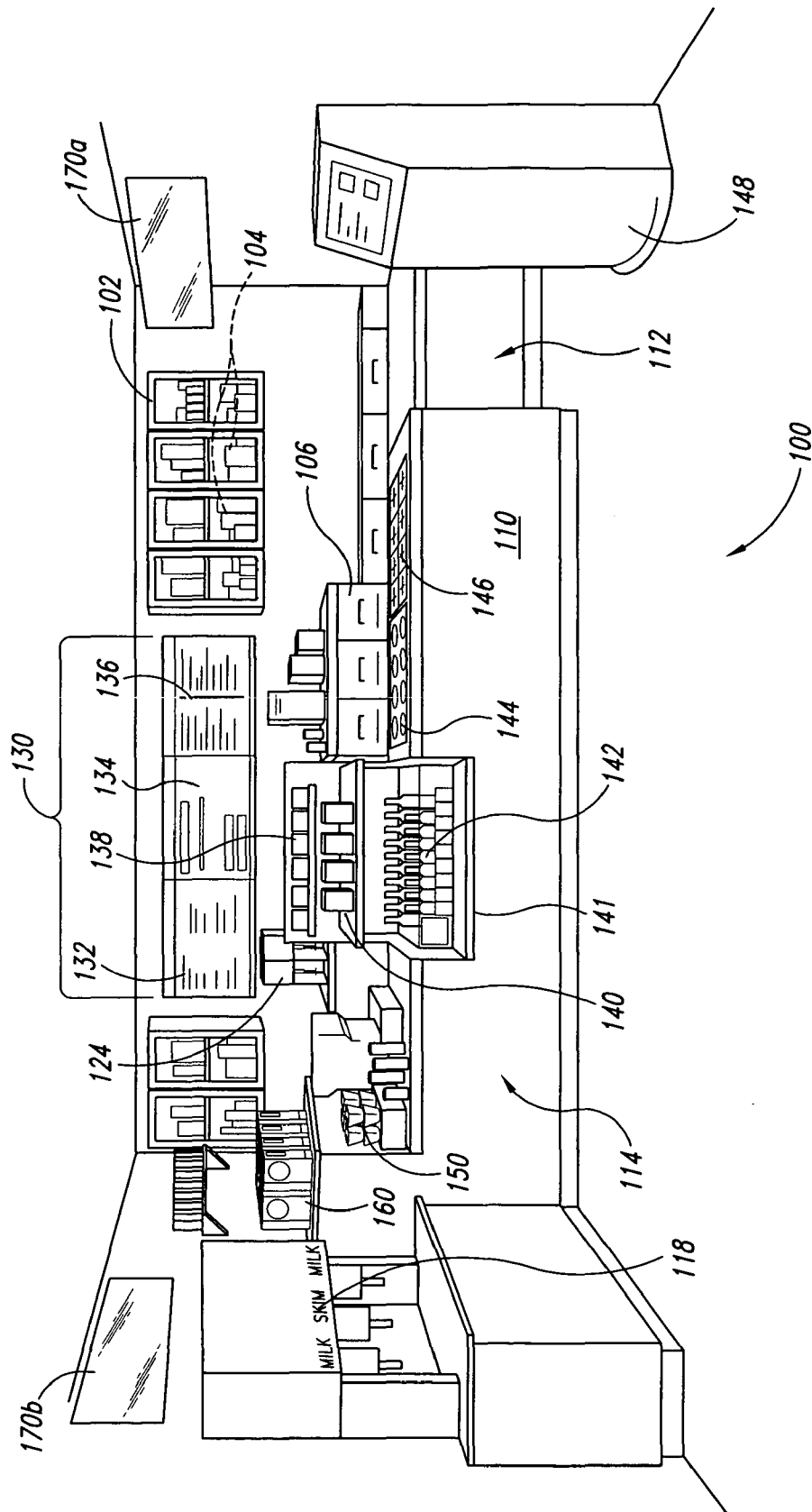


Fig. 1

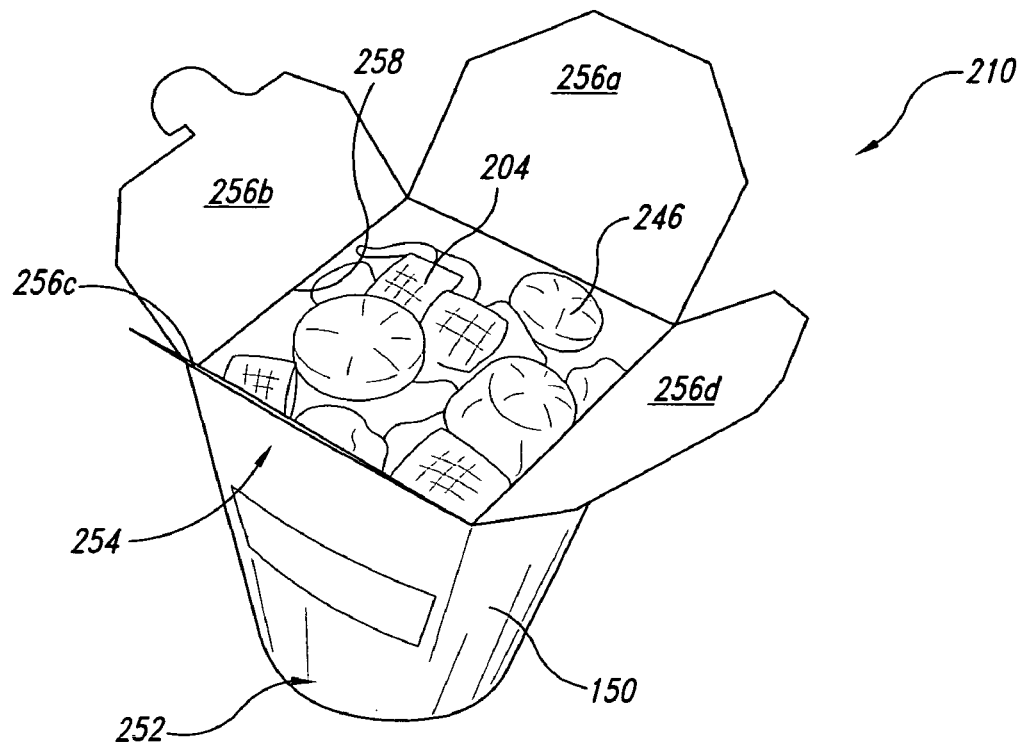


Fig. 2

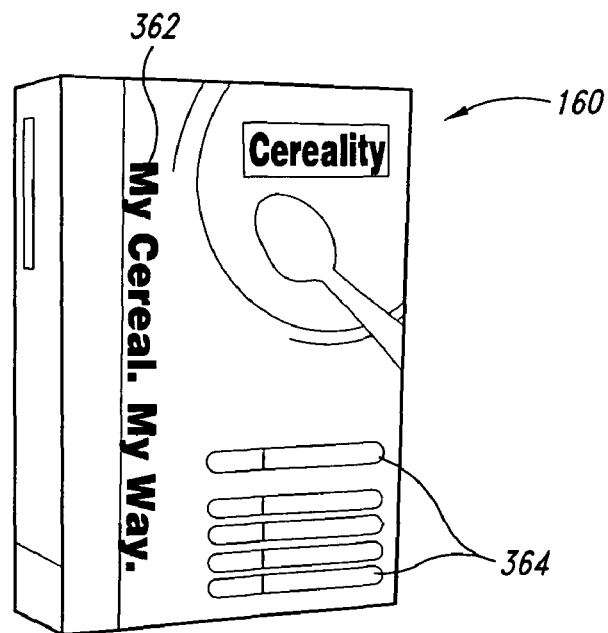
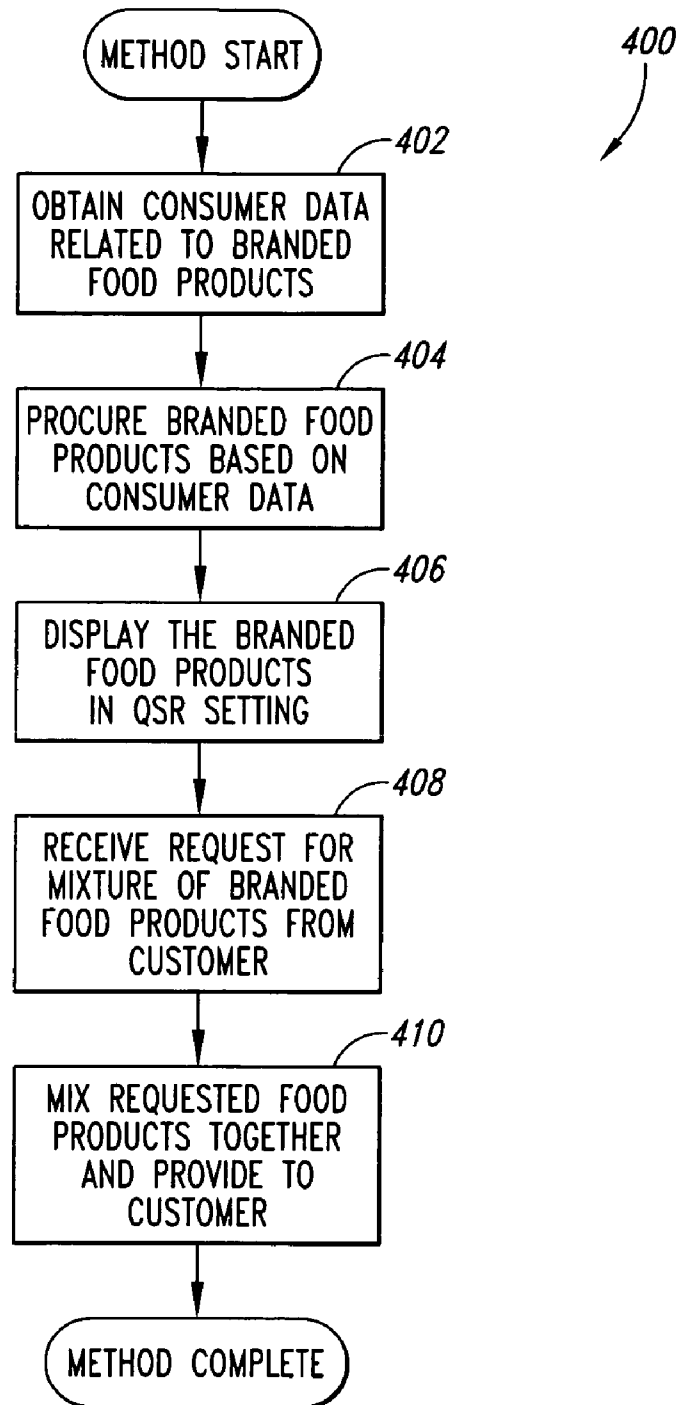


Fig. 3

*Fig. 4*

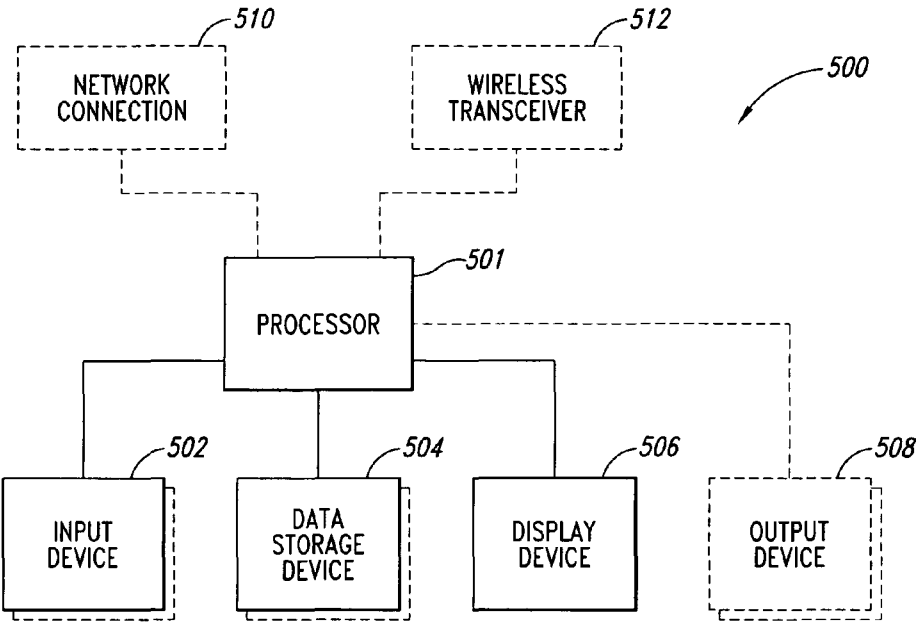


Fig. 5

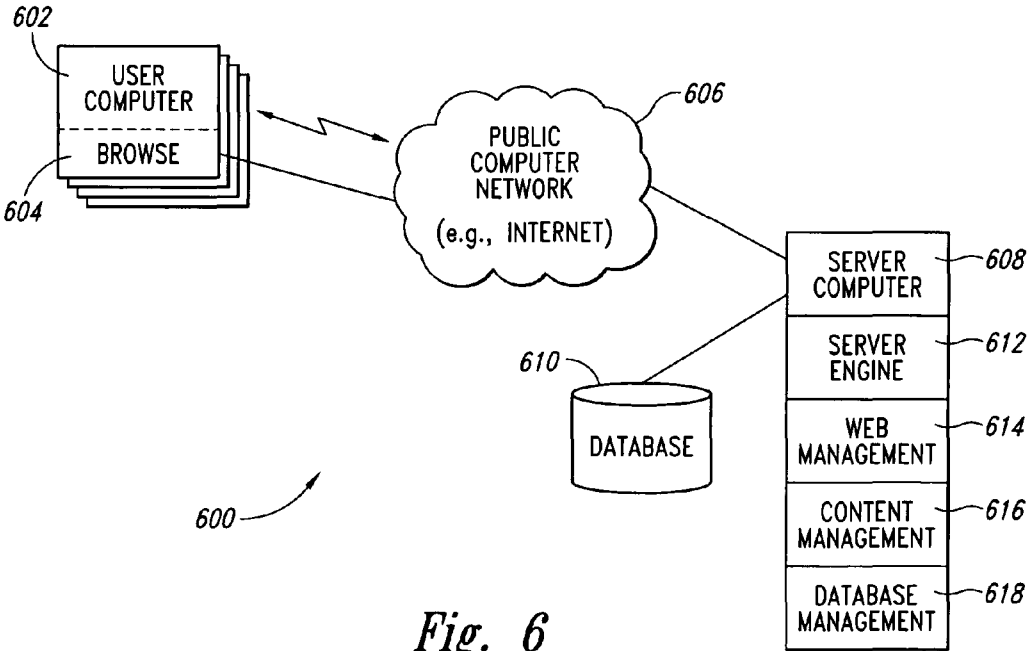


Fig. 6

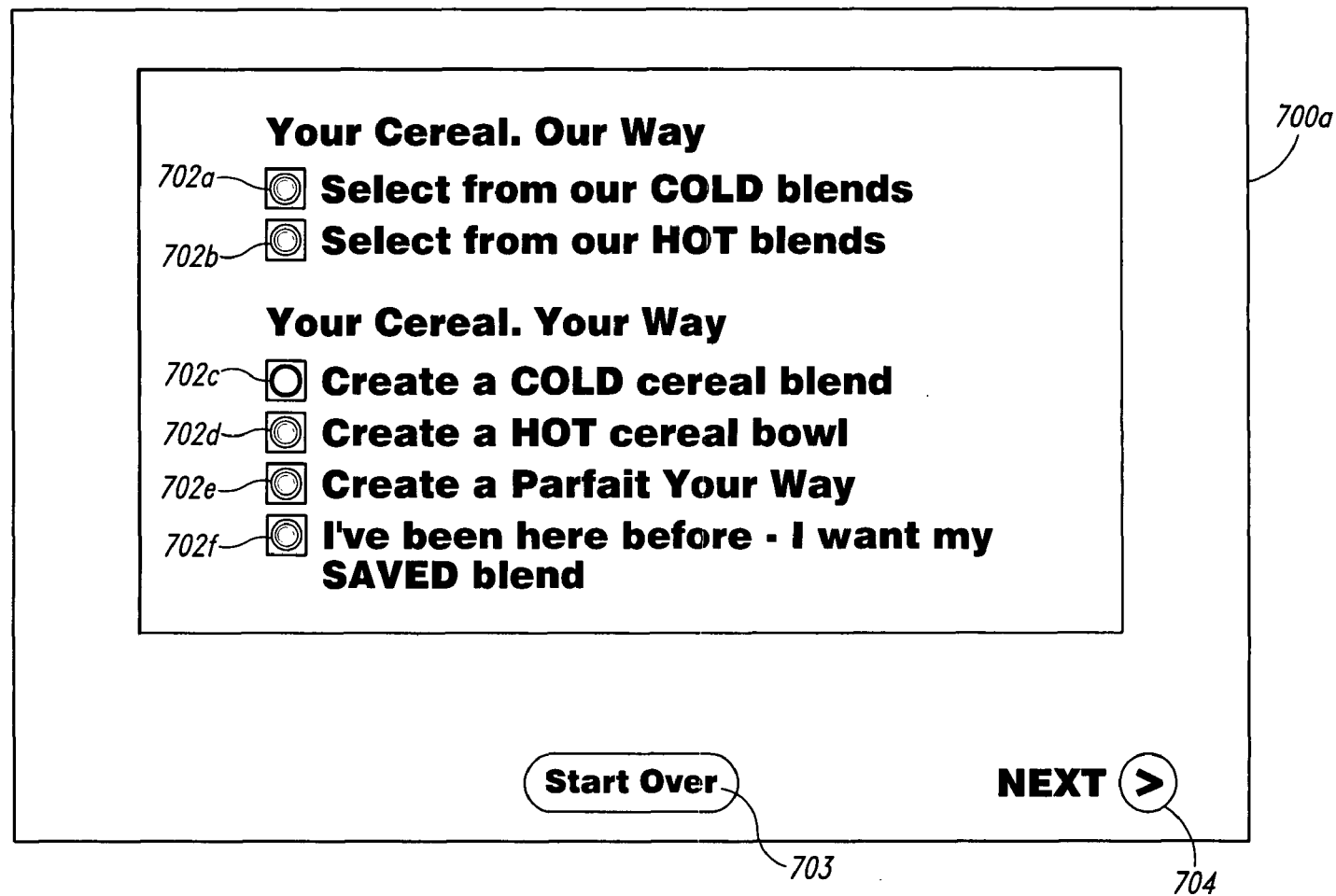








Fig. 7A

Select your SIZE:

| | | | |
|------|---|---|---------------|
| 712a |  | Bowl 2 scoops of cereal, 1 topping/mix-in and choice of milk | \$2.95 |
| 712b |  | Kid's Bowl 1 scoop of cereal and a choice of milk | \$1.95 |
| 712c |  | Cereality Granola (bowl) 2 scoops of our homemade granola(s) and a choice of milk | \$3.75 |
| 712d |  | Cereal Box 8 scoops of cereal(s) | \$4.50 |

 **BACK** **Start Over** **NEXT** 

716 714

Fig. 7B

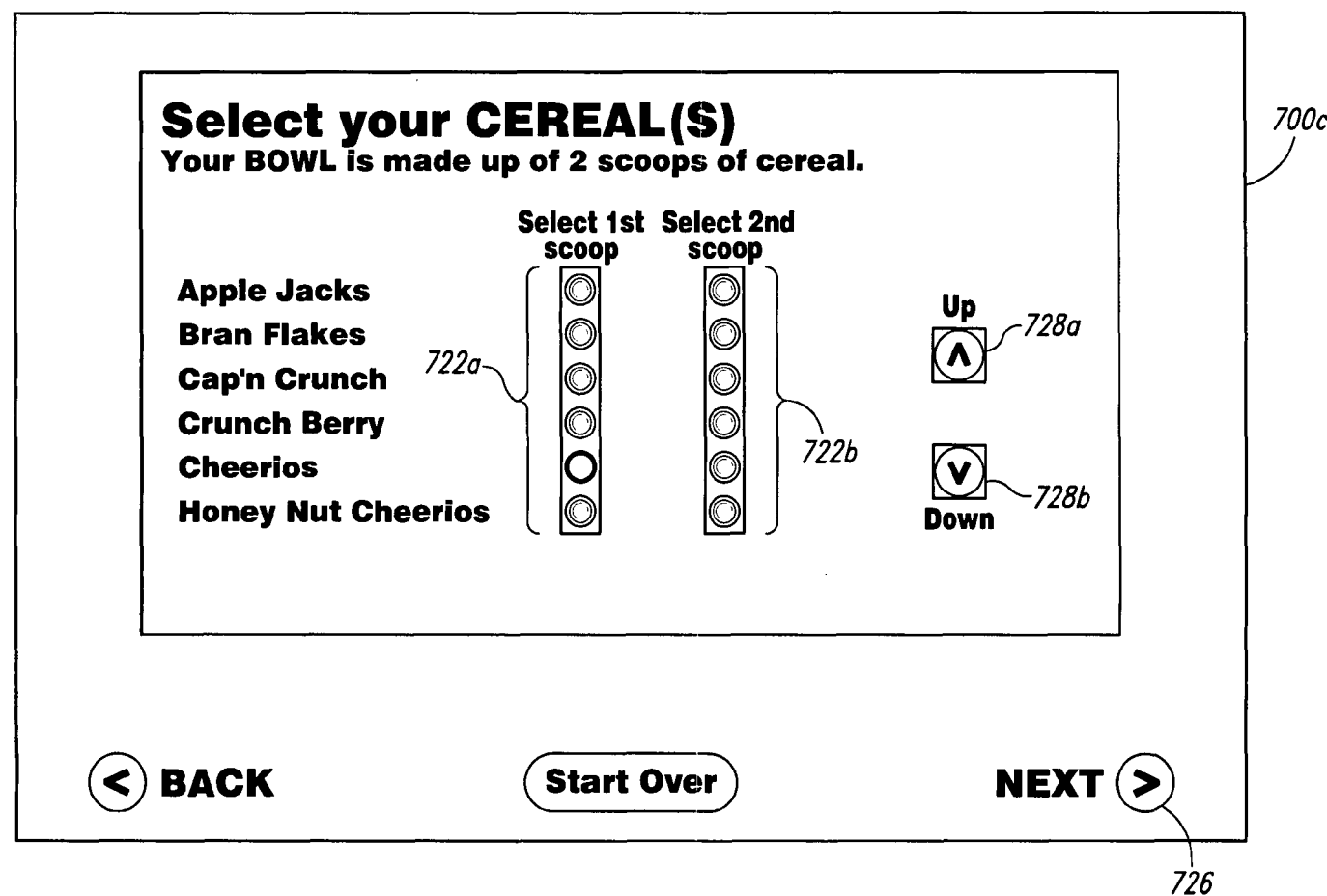


Fig. 7C

Patent Application Publication Jul. 21, 2005 Sheet 8 of 16 US 2005/0160005 A1

700d

Select 1 ITEM included with your order.
Add more items for 50¢ each.

| | | |
|--|---|--|
| <input type="checkbox"/> Almonds | <input type="checkbox"/> Bananas | <input type="checkbox"/> Blueberries |
| <input type="checkbox"/> Candy-Coated Chocolate | <input type="checkbox"/> Cereal Chunks | <input type="checkbox"/> Chocolate Chips |
| <input type="checkbox"/> Chocolate milk crystals | <input type="checkbox"/> Cinnamon Apples | <input type="checkbox"/> Cinnamon Struesel |
| <input type="checkbox"/> Coconut | <input type="checkbox"/> Crushed Hydrox Cookies | <input type="checkbox"/> Dried Apples |
| <input type="checkbox"/> Dried Apricots | <input type="checkbox"/> Dried Cherry pieces | <input type="checkbox"/> Dried Cranberries |
| <input type="checkbox"/> Golden Raisins | <input type="checkbox"/> Graham Bits | <input type="checkbox"/> Grape Nuts |

738a 732 738b

< Previous Toppings More Toppings >

734

Fig. 7D

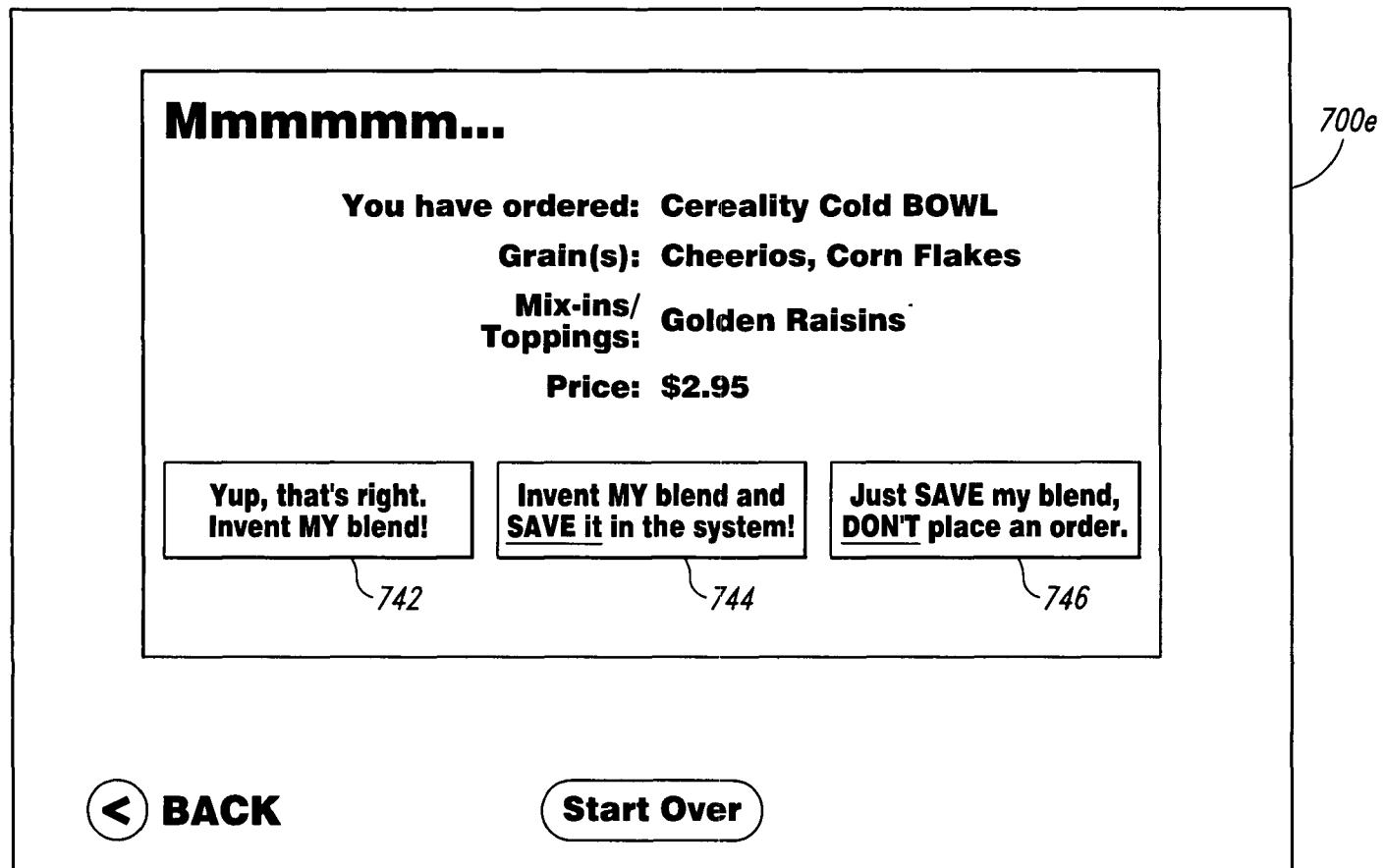


Fig. 7E

700f

Enter your User ID 756

[1234yum]

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 0 |
| Q | W | E | R | T | Y | U | I | O | P |
| A | S | D | F | G | H | J | K | L | . |
| @ | Z | X | C | V | B | N | M | . | _ |

752

DELETE CLEAR

Start Over

NEXT >

754

Fig. 7F

700g

Enter your Password

KAPNKRUNCH

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 0 |
| Q | W | E | R | T | Y | U | I | O | P |
| A | S | D | F | G | H | J | K | L | . |
| @ | Z | X | C | V | B | N | M | - | _ |

DELETE

CLEAR

Start Over

NEXT >

Fig. 7G

810a

| MAIN MENU | | | | | | | | | | Screen | |
|-----------|--|----------|--|------------|--|-----------|--|-----------|--|--------|--|
| VIEW | | MISC | | TOOLS | | 86 ITEM | | ITEM \$ | | | |
| 802 | | | | | | | | | | | |
| 2 SCOOP | | LIFE EXP | | B BR BETY | | B new day | | MILK | | | |
| SCOOOP | | HTH KICK | | ST FIELDS | | B SOY BOY | | SOY MILK | | | |
| TOPPINGS | | WB BABY | | COCO-NUT | | CHOC LOT | | \$1 WATER | | | |
| FRUIT | | DVL MADE | | HOT IAB | | CP COLAD | | BT WATER | | | |
| GRAN SCP | | BITES | | PARFAITS | | LF BEACH | | COFFEE | | | |
| GRAN BWL | | BOX | | BARS | | ICED TEA | | TEA | | | |
| GRAN BAG | | BAG | | | | HOT DRINK | | JUICE | | | |
| | | | | | | | | OT DRINKS | | | |
| TOTAL | | \$0.00 | | VOID CHECK | | UP | | ADD | | EXIT | |
| | | | | DOWN | | LESS | | SEND | | CLOSE | |
| | | | | | | | | PRINT | | | |

Fig. 8A

VIEW **MISC** **TOOLS**

1 CEREAL TWO SCOOP \$2.50

TOTAL \$2.72

VOID CHECK **UP** **DOWN** **ADD** **LESS** **CANCEL** **MORE...**

| | | | |
|---|-----------------|------------------|---------------|
| | APPLE JACKS | FRUIT LOOPS | LUCKY CHARMS |
| | BRAN | FROSTED FLAKES | OAT SQUARES |
| 1 | BRAN FLAKES | FRST MINI WHEATS | OATMEAL |
| 2 | CAPT CRUNCH | FRUITY PEBBLES | PUFFED CORN |
| 3 | CHEERIOS | GOLDEN GRAHAMS | PUFFED RICE |
| 4 | CIN TOST CRUNCH | GRAPE NUTS | RAISIN BRAN |
| 5 | CINNAMON LIFE | GRITS | RICE KRISPIES |
| 6 | COCO PUFFS | HNY NUT CHERIOS | SMACKS |
| 7 | CORN CHEX | HONEY GRAM OHS | SPECIAL K |
| 8 | CORN FLAKES | LIFE | TOASTED OATS |
| 9 | CRUNCH BERRIES | LIFE CINNAMON | WHEAT O'S |
| 0 | | | |

Fig. 8B

VIEW **MISC** **TOOLS**

MARTY MANA Custom 1

1 CEREAL TWO SCOOP \$2.50
1 APPLE JACKS \$0.00
1 GOLDEN GRAHAMS \$0.00

1 **2** **3** **4** **5** **6** **7** **8** **9** **0**

ALMONDS NC **CINN APPLES NC** Mini malt balls nc
Autmn fruit mix nc **COCONUT NC** **MINI MARSH NC**
BANANA NC **DRIED APPLES NC** **PECANS NC**
BLUBERRY NC Dried apricots nc **POP ROCKS NC**
BRAN NC **DRIED CHERRY NC** **PRALINE NUTS NC**
Carib trail mix nc **DRIED CRNBRY NC** **PRLINE CCNT NC**
CARM BANANA NC Golden raisin- nc **RAISINS NC**
CHARMS NC **GRAHAM BITS NC** **RED BRRY PDR NC**
CHOC SYRUP NC **GRANOLA NC** **RCKY RD BARK NC**
CHOC CHIPS NC **HONEY NC** Strawberries nc
CHOC HAZLNUT NC **MM'S NC** **STRUESEL NC**

VOID CHECK **UP** **ADD** **DOWN** **LESS** **CANCEL** **MORE...**

TOTAL \$2.72

812 810c

Fig. 8C

VIEW **MISC** **TOOLS**

MARTY MANA Custom 1

| | |
|--------------------|--------|
| 1 CEREAL TWO SCOOP | \$2.50 |
| 1 APPLE JACKS | \$0.00 |
| 1 GOLDEN GRAHAMS | \$0.00 |
| 1 DRIED APPLES NC | \$0.00 |
| 1 CEREAL TWO SCOOP | \$2.50 |

TOTAL \$5.43

VOID CHECK **UP** **ADD** **DOWN** **LESS** **CANCEL** **MORE...**

810d

| | | |
|---------------------------|--------------------------|---------------------------|
| WHEATIES | CINN APPLES NC | Mini malt balls nc |
| Autmn fruit mix nc | COCONUT NC | MINI MARSH NC |
| BANANA NC | DRIED APPLES NC | PECANS NC |
| BLUBERRY NC | Dried apricots nc | POP ROCKS NC |
| BRAN NC | DRIED CHERRY NC | PRALINE NUTS NC |
| Carib trail mix nc | DRIED CRNBRY NC | PRLINE CCNT NC |
| CARM BANANA NC | Golden raisin- nc | RAISINS NC |
| CHARMS NC | GRAHAM BITS NC | RED BRRY PDR NC |
| CHOC SYRUP NC | GRANOLA NC | RCKY RD BARK NC |
| CHOC CHIPS NC | HONEY NC | Strawberries nc |
| CHOC HAZLNUT NC | MM'S NC | STRUESEL NC |

Fig. 8D

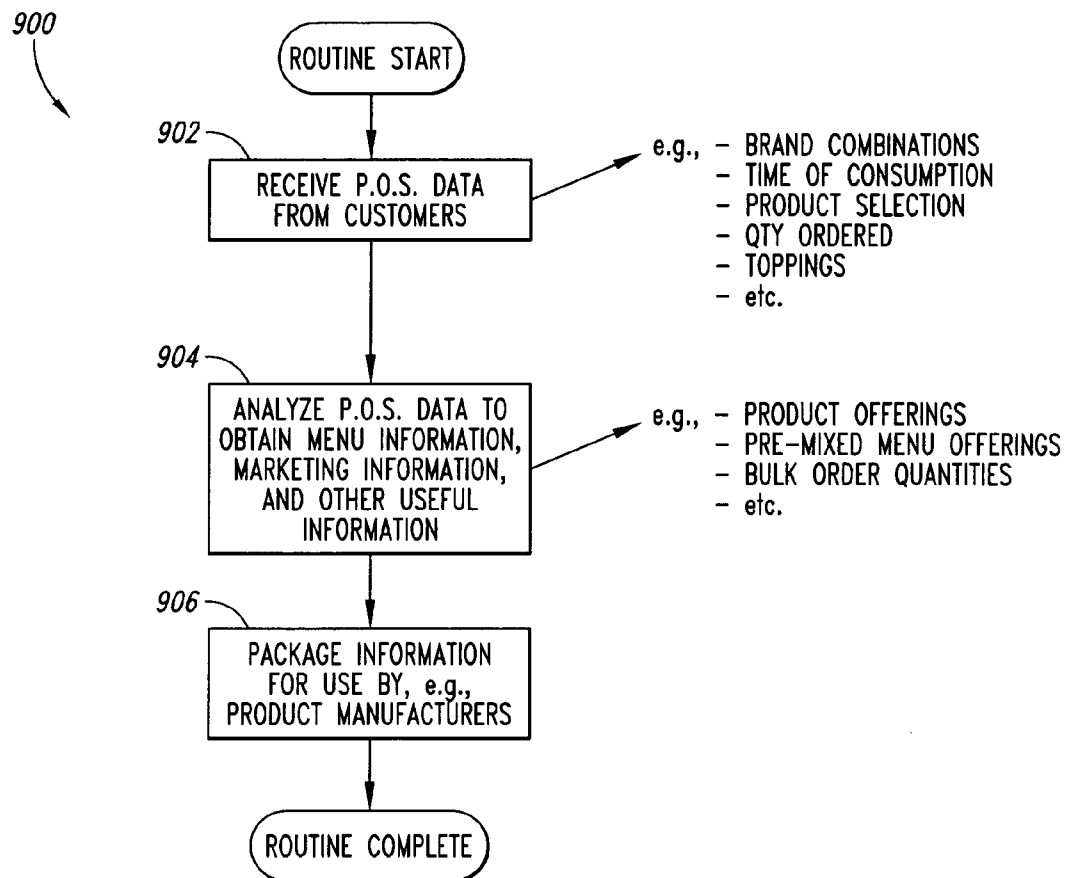


Fig. 9

US 2005/0160005 A1

Jul. 21, 2005

1

**METHODS AND SYSTEMS FOR PROVIDING
FOOD, BEVERAGES, AND ASSOCIATED GOODS
AND SERVICES IN A RETAIL ENVIRONMENT**

**CROSS REFERENCE TO RELATED
APPLICATIONS**

[0001] This application claims the benefit of co-pending U.S. Provisional patent application Ser. No. 60/604,504, entitled "METHODS AND SYSTEMS FOR PROVIDING FOOD, BEVERAGES, AND ASSOCIATED GOODS AND SERVICES IN A RETAIL ENVIRONMENT," filed Aug. 24, 2004; and co-pending U.S. Provisional patent application Ser. No. 60/565,984, entitled "METHODS AND SYSTEMS FOR PROVIDING FOOD, BEVERAGES, AND ASSOCIATED GOODS AND SERVICES IN A RETAIL ENVIRONMENT," filed Apr. 28, 2004; each of which is incorporated into this application by reference.

BACKGROUND

[0002] There are a wide variety of retail establishments at which consumers can purchase food to order. These include traditional "sit-down" restaurants as well as conventional "fast food" restaurants, not to mention grocery stores, supermarkets, and the like. While most grocery stores and supermarkets always carry a wide assortment of competitively-branded food products in their aisles, aside from beverages, restaurants rarely list two or more competitively-branded food products on their menus. Sit-down restaurants, for example, typically prepare meals from scratch and, as a result, their menus seldom list branded food products, much less competitively-branded food products. Furthermore, as a general rule, fast food restaurants only sell food under the franchise's brand. When fast food restaurants do offer foods under a different brand, this is typically done as a promotional or "limited time" offering only.

[0003] Occasionally, both sit-down and fast food restaurants will offer competitively-branded food products to their customers. Notwithstanding the typical liquor bar, however, these foods generally do not constitute core menu items. For example, while conventional sit-down or fast food restaurants may offer one or two different types of competitively-branded beverages to accompany a meal (e.g., Coke®, Pepsi®, etc.), they typically do not offer competitively-branded food products as the main course. Further, while conventional restaurants may offer one or two competitively-branded items as a dessert or condiment (e.g., Heinz® Ketchup versus A1 Steak Sauce®), they typically do not offer a wide range of competing products in these categories from which the customer can choose.

[0004] On or about Jun. 12, 2001, General Mills, Inc. opened the "Cereal Adventure" attraction at the Mall of America in Bloomington, Minn. The attraction, which has since closed down, was billed as a playful, interactive learning experience where kids could immerse themselves in the world of General Mills' cereals. Among the entertainment features, Cereal Adventure included "Cheerios® Play Park," "Trix® Fruity Carnival," and "Lucky Charms® Magical Forest." in addition, at the "Wheaties® Hall of Champions," visitors could pose for their own souvenir Wheaties box with their picture on it. The "Make Your Own Cereal" feature allowed visitors to create their own unique brand of cereal using General Mills' products, including creating the

name of the cereal, box design, and contents. For a price, visitors could take their customized cereal home.

[0005] Kellogg's Cereal City USA™ in Battle Creek, Mich. is designed to entertain visitors while informing them about the cereal industry and Kellogg's products in particular. Cereal City is a combined museum, factory tour, and theme attraction that houses interactive exhibits, theaters, play areas, and a themed diner. For visitors who want a memento, they can take home a box of Kellogg's Frosted Flakes® cereal with their photo on it. Cereal City also includes a restaurant that offers fast food in addition to desserts, such as a "Fruit Loops® Sundae."

BRIEF DESCRIPTION OF THE DRAWINGS

[0006] FIG. 1 is a perspective view of a Quick Service Restaurant (QSR) configured in accordance with an embodiment of the invention.

[0007] FIG. 2 is an isometric view of a food order prepared in accordance with an embodiment of the invention.

[0008] FIG. 3 is an isometric view of a container for holding a combination of customer-selected, single category, independently-branded food products in accordance with an embodiment of the invention.

[0009] FIG. 4 is a flow diagram illustrating a method for providing competitively-branded food products in a single food category to customers in accordance with an embodiment of the invention.

[0010] FIG. 5 is a schematic diagram illustrating a suitable computer for employing aspects of the invention.

[0011] FIG. 6 is a schematic diagram illustrating a suitable system in which aspects of the invention may operate in a networked computer environment.

[0012] FIGS. 7A-7G illustrate a series of screen displays for selecting, ordering, and/or recording various combinations of competitively-branded food products in accordance with an embodiment of the invention.

[0013] FIGS. 8A-8D illustrate a series of screen displays for taking a customer order at a point-of-sale in accordance with an embodiment of the invention.

[0014] FIG. 9 is a flow diagram illustrating a routine for obtaining and/or mining customer point-of-sale data in accordance with an embodiment of the invention.

[0015] Note: The headings provided herein are for convenience only, and do not necessarily affect the scope or interpretation of the invention.

[0016] This disclosure contains material for which a claim for copyright is made. The copyright owner has no objection to the facsimile reproduction by anyone of the patent document or patent disclosure (including the Figures) as it appears in the Patent and Trademark Office patent file or records, but the copyright owner reserves all other copyright rights whatsoever.

DETAILED DESCRIPTION

[0017] In broad terms, the following disclosure describes various systems and methods for providing food and other products to consumers in a convenient, retail setting. Certain

US 2005/0160005 A1

Jul. 21, 2005

2

details are set forth in the following description to provide a thorough understanding of various embodiments of the invention. Other details describing well-known structures and systems often associated with food service establishments are not set forth, however, to avoid unnecessarily obscuring the description of the various embodiments. Further, those of ordinary skill in the art will appreciate that other embodiments of the invention may be practiced without at least some of the details described herein.

[0018] Overview

[0019] In one embodiment described in greater detail below, a system for providing competitively-branded food products to consumers includes a quick-service restaurant (QSR) that displays the products in their readily-recognizable, retail-sale containers. As used herein, the term “competitively-branded” generally refers to foods that fall into the same category (e.g., cereals), but are produced by competing manufacturers (e.g., Kellogg’s and General Mills) and sold under different brand names (e.g., Cheerios®, Fruit Loops®, Chex®, etc.). In one aspect of this embodiment, the system enables and encourages customers to order unique combinations of competitively-branded cereals to suit their own particular tastes. The orders are prepared by an employee of the QSR who combines the selection together with one or more toppings in a convenient, carry-out bowl having a closeable lid. The consumer may then add milk and enjoy the cereal on the premises, or seal the container and take it to enjoy later.

[0020] A QSR configured in accordance with another embodiment of the invention has the look and feel of a residential kitchen complete with over-the-counter food cabinets. The cabinets can have glass fronts to display an array of competitively-branded cereal boxes. Graphically displaying the different cereal choices in this manner gives the customers visual reference cues that are more compelling than simply displaying raw cereal in see-through holding bins. (As explained below, cereal is provided in drawer or bins in the QSR, but these bins are behind the counter and not accessible or typically viewable by consumers.) Displaying the readily-recognizable cereal boxes to the customers sparks an immediate taste-association with the customer, and lets him or her know immediately what types of cereal are offered and what he or she can expect. Conversely, merely identifying “granola” as a generic menu item often leaves the customer wondering what type (i.e., what brand) of granola is being offered. Indeed, it is quite rare to see competitively-branded foods advertised by their retail-sale containers as the core menu items in a restaurant setting, and even rarer to see a menu that encourages ordering unique combinations of such foods.

[0021] The QSR can include a number of entertainment features often associated with cereal and/or the cereal-eating experience. For example, in one embodiment, the QSR can include one or more viewing screens (e.g., video screens) that show familiar “Saturday morning” cartoons for viewing by customers.

[0022] In another embodiment, the QSR can provide hot cereal to order. For example, employees can make hot cereal mixtures one batch at a time using a pan and induction burner. In addition or alternatively, a rice cooker or other device can be advantageously employed to make the hot cereal and maintain it at temperature until sold/served.

[0023] Various hot cereal dishes prepared by the QSR can include oats. For example, in addition to commercially available “quick-cooking” oats, the QSR can also prepare dishes with rolled oats that have been presoaked for a period of time in water. In one embodiment, the oats are mixed with water (and optional salt) in proportions similar to conventional preparation instructions (e.g., in proportions of about 1 part oats to about 4-5 parts water; such as about 1 part oats to about 4.6 parts water) and held for about 1 hour prior to usage. The relative proportions of the oats, water, and/or other ingredients, the hold time and the water temperature may be varied to achieve different results as desired. Pre-soaking the oats in this manner causes the oats to cook quicker and allows for the usage of longer cooking oats in this quick preparation setting.

[0024] The layout of the QSR is configured to permit efficient use of a small space, such that the induction burner, rice cooker, and/or dishwasher are effectively co-located. In this embodiment, customers move from a point-of-sale leftward to a central cereal mixing location. At this location, employees remove the selected cereals from storage bins located behind the counter, and mix the cereals together in an appropriate container. From here, the customers can view an arrangement of different toppings (both dry toppings and wet toppings) displayed on the counter, and can select one or more of the toppings for addition to the cereal order. After receiving their orders, the customers can proceed further leftward to add milk to the cereal at a milk station.

[0025] As explained below, the cereal is provided in various forms, not only hot or cold cereal in a bowl, but also blended with yogurt and/or other liquids to provide smoothies or other beverages, as well as combined to form cereal bars or snack mixes. Other products can include steamed dairy or soy milk to which flavoring and/or other products can be added. Products can also include various types of frozen dairy and non-dairy food items combined with cereal, such as frozen dairy and non-dairy products sandwiched between two bakery items that include cereal. Products can further include muffins and other baked goods made with various types of cereal. In addition, yogurt parfaits can include one or more layers of cereal between yogurt and fruit, and the yogurt may be frozen or replaced with ice cream. One or more different types of sweeteners may be added to cereal, including molasses, sugar, maple syrup and other flavored syrups, artificial sweeteners, honey, and so forth. Further, various toppings may be combined with the cereal, including bananas, raisins, candy, etc. Another menu item can include a “bowl” made with cereal, from which yogurt, ice cream and other food products (including more cereal) can be consumed before eating the bowl. Similar menu items include ice cream cone shells that are made from cereal. Still other menu items that may or may not include cereal can include custards, puddings, wraps (e.g., tortilla wraps), cookies, waffles, bagels, cakes, pies, pizza-like products, sandwiches, roll-ups, omelets, etc.

[0026] In a further embodiment, each QSR location can include one or more point-of-sale devices that gather information. This information may be repackaged and sold to manufacturers of various products or items sold at the QSR locations. Indeed, much of the information gathered reflects market research of spending habits of customers at each QSR. Information gathered at each point-of-sale can include the following:

US 2005/0160005 A1

Jul. 21, 2005

3

- [0027] types of cereal ordered, cereal combinations ordered, cereal combinations ordered for particular customers and/or particular customer demographics;
- [0028] toppings added to cereal (e.g., whether fresh versus dried fruit is more popular);
- [0029] brand loyalty (whether customers mix cereals of the same brand or not);
- [0030] smoothies (“Slurrealities™”) and customer changes to predetermined smoothie recipes;
- [0031] time-of-day habits;
- [0032] volume purchased (e.g., bowls versus boxes of cereal versus cereal bars);
- [0033] complementary sales (e.g., coffee);
- [0034] use of frequent-user cards, stored-value cards, or the like;
- [0035] repetitiveness (e.g., do customers order the same item or items each time?);
- [0036] trials (e.g., at what rate does a new item break into the sales mix?);
- [0037] seasonality (e.g., does the product sales mix vary throughout the year?); and
- [0038] event purchasing (e.g., do external events impact product purchasing?)

[0039] Many other types of information may be gathered, such as details on each sale, price of the sale, average sale per transaction per time of day, and so forth. Indeed, the point-of-sale device can gather information regarding each specific type of cereal or types of cereals added to a given order, the type of topping, the amount of each ingredient (cereal, topping, etc.), and so forth for every order. A suitable point-of-sale device can be any computer-driven point-of-sale device, and thus includes any type of computing device. Further, various aspects of the systems and methods described above can be implemented in a networked computer environment, such as the environment described in detail below with reference to **FIGS. 5 and 6**.

EXAMPLE OF A SUITABLE RESTAURANT CONFIGURATION

[0040] **FIG. 1** is a front perspective view of a QSR **100** configured in accordance with an embodiment of the invention. The QSR **100** and selected variations thereof can be configured as a walk-up bar in public thoroughfares (e.g., college campuses, airports, train stations, shopping malls, etc.), or as a storefront business such as a café or restaurant. In one aspect of this embodiment, the QSR **100** includes multiple display cabinets **102** positioned above and behind a service bar **110**. Each of the display cabinets **102** can hold multiple retail-sale packages **104** for multiple competitively-branded, single-category food products. For example, in the illustrated embodiment the display cabinets **102** hold an array of breakfast cereal boxes (e.g., a Cheerios® box, a Frosted Flakes® box, a Capt’n Crunch® box, etc.). Arranging the competitively-branded cereal boxes in the display cabinets **102** in plain view of the customers (not shown) provides the customers with an immediate sensory connection to the various menu items on offer.

[0041] Multiple storage bins **106** are positioned behind the service bar **110** and generally below the display cabinets **102**. As described below, the storage bins **106** contain, among other things, bulk supplies of the various breakfast cereals displayed in the cabinets **102**. When a customer places an order, an employee of the QSR **100** (referred to in one embodiment as a “Cereologists”) removes the selected cereals from the storage bins **106** to prepare the order. In one embodiment, the storage bins **106** can include dispensing apparatus configured to deliver a pre-determined amount of cereal into a carry-out or serving container. This feature facilitates accurate product proportioning and an efficient first-in/first-out rotation of the product contained in the storage bins **106**.

[0042] A menu board **130** is positioned above and behind the service bar **110** adjacent to the display cabinets **102**. In the illustrated embodiment, the menu **130** is divided into three different sections. A first menu section **132** (“Your Cereal. Your Way.”) allows customers to choose from a list of different competitively-branded cereals and have them prepared as they desire. The competitively-branded cereals can include cereals currently sold in supermarkets, as well as a variety of other cereals. These other cereals can include, for example, nostalgic names (e.g., Quisp®) and other discontinued cereals (e.g., Vanilla Capt’n Crunch®) that may no longer be available on the supermarket shelves. These cereals can also include specialty cereals, such as organic cereals and popular cereals from other countries. When ordering from this menu section, customers can create cereal mixes just the way they like them. Specifically, they can mix and match their favorite brand-name cereals in a single bowl and add one or more different toppings. Alternatively, they can mix various brand-name cereals together and purchase them in bulk in a small to-go bag (e.g., 3 scoops) or a large carry-out box (e.g., 6 scoops).

[0043] A second menu section **134** (“Your Cereal. Our Way.”) includes specialty cereal mixes created by the QSR **100**. This menu section enables customers to experiment with both hot and cold cereal blends they may not have ever thought of, such as “Life Experience™” (i.e., Life® Cereal with almonds, honey, and topped with bananas). A third menu section **136** (“Your Cereal. A Whole New Way.”) offers various menu items that include cereal in creative ways. For example, in one embodiment this menu section can include smoothies (“Slurrealities™”) made from different types of yogurt, cereal, fruit juice, etc. This menu section can also include various baked goods made from cereals, including cereal bars (“Cereality Bars™”) and snack mixes (“Cereality Bites™”). This section of the menu can also include various parfaits (“Parfaits Your Way™”) made with, for example, yogurt, cereal and fruit.

[0044] Many of the food items listed on the menu **130** are situated on or near the service bar **110** in plain view of the customers. For example, multiple different toppings **146** are arranged on the service bar **110** just to the left of an order station **112**. The toppings can include, for example, sliced bananas, cinnamon apples, strawberries, raisins, sliced almonds, pumpkin seeds, Pop Rocks®, etc. Flavored milk crystals **144** can be placed next to the toppings **146** on the service bar **110**. The milk crystals **144** can include various flavors, such as chocolate hazelnut, caramelized banana, red berry, etc. Parfaits **142** can be arranged in a display case **141** in a central portion of the service bar **110**. As discussed

US 2005/0160005 A1

Jul. 21, 2005

4

above, the parfaits can include various flavors of yogurt combined with one or more different types of fruit, fruit juice, and/or branded cereal. Various cereal snack mixes **138** and cereal bars **140** can also be arranged in the display case **141** with the parfaits **142**. The cereal snack mixes **138** can include various sweet and/or savory cereal mixes. For example, the cereal snack mixes **138** can include "Cinnamon-Oh-Man" (a mixture of cinnamon cereals, dried apples, raisins, etc.), "Tiki Torch Granola," and "Honey Mustard Munch." The cereal bars **140** can include, for example, "Raisin' the Roof Bran Snackin' Cake" made with Quaker Oats® and Quaker Bran Flakes®, and "S'mores Bar" made with Quaker Honey Graham Oh's®.

[0045] In addition to these cereal bars, in another embodiment of the QSR **100**, customers can also order "customized" cereal bars. Customized cereal bars can include, for example, chewy granola bars and other types of bars made to order. In this regard, the QSR **100** can include a cereal bar pressing device (not shown) or similar system that combines the customer-selected ingredients together and presses them into a bar without an associated cooking process. Customers can select from a list of core ingredients (e.g., oats, fruit, nuts, chocolate chips, etc.) to suit their taste. Further, the customers can also select from various nutritive and non-nutritive additives and/or coatings to enhance the product.

[0046] Also illustrated in FIG. 1 are multiple viewing screens **170** (identified individually as a first viewing screen **170a** and a second viewing screen **170b**). As mentioned above, in one embodiment the viewing screens **170** can be configured to show animated features for viewing by customers. The animated features can include familiar "Saturday morning" cartoons and other subject matter often associated with cereal and/or the breakfast dining experience.

[0047] A customer (not shown) desiring to place an order at the QSR **100** approaches the order station **112** and places his or her order with an employee (also not shown) standing behind the service bar **110**. After taking the order, the employee moves in the direction of customer flow and begins preparing the order. For example, if the customer orders a cereal combination, the employee removes the appropriate portions of the selected cereals from the storage bins **106** and mixes them together in a suitable bowl. In one embodiment, if the customer orders cereal "By the Bowl" for take-out or consumption at the QSR **100**, the order can be prepared and served in a convenient carry-out container or bucket **150**. The carry-out bucket **150** is described in more detail below with reference to FIG. 2. Alternatively, if the customer orders cereal "By the Bulk," the order can be prepared in either a small (e.g., 3 scoops) to-go bag (not shown) or a large (e.g., 6 scoops) carry-out box **160**. Various aspects of the carry-out box **160** are described in greater detail below with reference to FIG. 3.

[0048] After the employee has placed the selected cereals in the appropriate container, the employee can add whatever toppings **146** the customer ordered. Alternatively, the customer can choose to have the toppings placed in the container before the cereal, or in some other order of his or her choosing. In addition, the customer or employee can remove one or more of the parfaits **142**, the cereal snack mixes **138**, or the cereal bars **140** from the display case **141** to add to the order if desired. If the customer orders a smoothie (e.g., a "Slurrreality™"), the employee can prepare it using one or

more of the blending devices **124** positioned behind the service bar **110**. After taking any other steps necessary to complete the order, the employee moves toward a check-out station **114** to deliver the order to the customer.

[0049] If the customer wishes to consume the cereal immediately, the customer can take his or her cereal container over to a milk dispenser **118** and add one or more different types of milk. In the illustrated embodiment, the milk dispenser **118** can dispense various types of fresh dairy milk (e.g., whole, skim, or 2%) and/or various specialty milks such as soy milk. Alternatively, the customer may elect to not add milk right away, but instead take the cereal home for consumption at a later time.

[0050] In another aspect of this embodiment, the QSR **100** can include an interactive, stand-alone kiosk **148** with which customers can create unique cereal orders (i.e., "Invent-a-Blend") and automatically send the orders to a QSR employee for preparation. Various aspects of the interactive kiosk **148** are described in greater detail below with reference to FIGS. 8A-8G.

EXAMPLES OF A PREPARED FOOD ORDER AND ASSOCIATED CONTAINERS

[0051] FIG. 2 is an isometric view of a food order **210** prepared in accordance with an embodiment of the invention. In one aspect of this embodiment, the food order **210** includes a mixture of competitively-branded cereals **204** and toppings **246** (e.g., bananas) combined in the convenient carry-out bucket **150** of FIG. 1. The carry-out bucket **150** includes a generally circular base portion **252** transitioning upward into a generally square top portion **254**. Multiple closable flaps **256** (identified individually as flaps **256a-d**) are hingeably attached to the top portion **254**, and can be foldably interleaved to close off an opening **258** in the top portion **254**.

[0052] In one embodiment, the carry-out bucket **150** can be manufactured from a suitable paperboard material. In other embodiments, the bucket **150** and variations thereof can be manufactured from other materials, including plastics, metals, and other suitably durable materials. Further, various aspects of the carry-out container **150** can be at least generally similar in structure and function to one or more of the containers disclosed in U.S. Pat. No. 5,358,175, which is incorporated herein in its entirety by reference. One feature of the bucket **150** is that it can hold liquids, such as milk, without leaking. One advantage of this feature is that it enables the bucket **150** to be used as a serving bowl or as a convenient transport/storage container.

[0053] FIG. 3 is an enlarged isometric view of the carry-out box **160** of FIG. 1, configured in accordance with an embodiment of the invention. Various aspects of the carry-out box **160** can be at least generally similar in structure and function to a conventional cereal box. In the illustrated embodiment, however, the carry-out box **160** includes a number of distinguishing features, including a unique label **362** (e.g., "My cereal. My way.") and multiple data-entry fields **364**. In the data-entry fields **364**, the customer can write various information about the particular contents of the container **360**. This information can include, for example, the customer's name, a coined name for the particular cereal and/or topping combination, the inspiration for the particular combination, the date of purchase, and other information

US 2005/0160005 A1

Jul. 21, 2005

5

such as suggested toppings or other food items that may go well with the particular combination. In addition or alternatively, all or a portion of the data-entry fields **364** can be automatically filled out by an associated computer system after entry of customer information.

EXAMPLE OF A METHOD OF OPERATION

[0054] **FIG. 4** is a flow diagram of a method **400** for providing competitively-branded, single-category food products in a QSR setting in accordance with an embodiment of the invention. In block **402**, the method **400** obtains consumer data relating to competitively-branded food products (e.g., cereals). In this embodiment, "consumer data" can relate to, for example, which brands of cereal consumers prefer and which combinations of cereals and associated toppings they would be most inclined to purchase. In block **404**, the method **400** procures the branded food products from a bulk provider or different manufacturers based on the consumer data obtained in block **402**. For example, staying with the cereal embodiment, the method **400** procures the different brands of cereal from the various cereal manufacturers, such as General Mills, Kellogg's, etc. In block **406**, the method **400** displays the branded food products in a QSR setting. For example, in the cereal embodiment, the method **400** could display the various types of competitively-branded cereal products to customers in a homey, kitchen-type setting. The displays can include various toppings that can be combined with the cereal products, as well as drinks, e.g., coffee, and other accompanying items such as smoothies ("Slurrealities™"), cereal bars, snack mixes, etc.

[0055] In block **408** the method **400** receives a request for a mixture of the competitively-branded food products from a customer. In block **410**, the method **400** mixes the requested food products together and provides them to the customer in a convenient container (e.g., the carry-out bucket **150** described above with reference to **FIG. 2**). In the cereal embodiment, the customer can then add milk or other liquid (e.g., soy milk) to the cereal and consume it at the QSR location. Alternatively, the customer may take the mixture with them to enjoy later. After block **410**, the method **400** is complete.

EXAMPLE OF A SUITABLE DATA PROCESSING SYSTEM

[0056] Various aspects of the restaurants described above can be implemented or facilitated with use of a suitable computing system. These aspects include, for example, food ordering and customer data gathering. **FIG. 5** and the following discussion provide a brief, general description of a computing environment suitable for use with the present invention. Although not required, aspects and embodiments of the invention will be described in the general context of computer-executable instructions, such as routines executed by a general-purpose computer, e.g., a server or personal computer. Those skilled in the relevant art will appreciate that the invention can be practiced with other computer system configurations, including Internet appliances, handheld devices, wearable computers, cellular or mobile phones, multi-processor systems, microprocessor-based or programmable consumer electronics, set-top boxes, network PCs, mini-computers, mainframe computers and the like. The invention can be embodied in a special purpose computer or data processor that is specifically programmed,

configured or constructed to perform one or more of the computer-executable instructions explained in detail below. Indeed, the term "computer," as used generally herein, refers to any of the above devices, as well as any data processor.

[0057] Various aspects of the invention can also be practiced in distributed computing environments, where tasks or modules are performed by remote processing devices which are linked through a communications network, such as a Local Area Network ("LAN"), Wide Area Network ("WAN") or the Internet. In a distributed computing environment, program modules or sub-routines may be located in both local and remote memory storage devices.

[0058] Other aspects of the invention may be stored or distributed on computer-readable media, including magnetic and optically readable and removable computer discs, stored as firmware in chips (e.g., EEPROM chips), as well as distributed electronically over the Internet or over other networks (including wireless networks). Those skilled in the relevant art will recognize that some portions of the invention may reside on a server computer, while other portions may reside on a client computer. Further, data structures and data transmissions particular to aspects of the invention are also encompassed within the scope of the invention.

[0059] Referring to **FIG. 5**, one embodiment of the invention employs a computer **500** (e.g., a personal or portable computer, workstation, stand-alone kiosk, point-of-sale device, mobile phone, etc.) having one or more processors **501** coupled to one or more user input devices **502** and data storage devices **504**. The computer **500** is also coupled to at least one output device, such as a display device **506**, and one or more optional output devices **508** (e.g., a printer, a plotter, speakers, tactile or olfactory output devices, etc.). The computer **500** may be coupled to external computers, such as via an optional network connection **510**, a wireless transceiver **512**, or both.

[0060] The input devices **502** may include a keyboard and/or a pointing device such as a mouse. Other input devices are possible such as a microphone, joystick, pen, game pad, scanner, digital camera, video camera, and the like. The data storage devices **504** may include any type of computer-readable media that can store data accessible by the computer **500**, such as magnetic hard and floppy disk drives, optical disk drives, magnetic cassettes, tape drives, flash memory cards, digital video disks (DVDs), Bernoulli cartridges, RAMs, ROMs, smart cards, etc. Indeed, any medium for storing or transmitting computer-readable instructions and data may be employed, including a connection port to a network such as a local area network (LAN), wide area network (WAN) or the Internet (not shown in **FIG. 5**).

[0061] Aspects of the invention may be practiced in a variety of computing environments. **FIG. 6**, for example, illustrates a suitable computer system **600** having a web interface and one or more user computers **602**. Each of the user computers **602** can include a browser program module **604** that permits the computer to access and exchange data with the Internet **606**, including web sites within the World Wide Web portion of the Internet. The user computers may be substantially similar to the computer **600** described above with reference to **FIG. 5**. User computers may include other program modules such as an operating system, one or more application programs (e.g., word processing or spreadsheet

US 2005/0160005 A1

Jul. 21, 2005

6

applications), and the like. The computers may be general-purpose devices that can be programmed to run various types of applications, or single-purpose devices optimized or limited to a particular function or class of functions.

[0062] At least one server computer **608**, coupled to the Internet or World Wide Web (“Web”) **606**, performs many or all of the functions for receiving, routing, and storing of electronic messages, such as web pages, audio signals and electronic images. While the Internet is shown, a private network, such as an intranet, may likewise be used herein. The network may have a client-server architecture in which one computer is dedicated to serving other client computers; or it may have other architectures, such as peer-to-peer, in which one or more computers simultaneously act as both servers and clients. A database **610** or databases, coupled to the server computer(s) **608**, stores many of the web pages and content exchanged between user computers.

[0063] The server computer **608** can include a server engine **612**, a web page management component **614**, a content management component **616** and a database management component **618**. The server engine **612** performs basic processing and operating-system-level tasks. The web page management component **614** handles creation and display or routing of web pages. Users may access the server computer **608** by means of a URL associated therewith. The content management component **616** handles most of the functions in the embodiments described herein. The database management component **618** performs storage and retrieval tasks with respect to the database, queries to the database, and storage of data such as cereal inventory, point-of-sale data, etc.

[0064] One skilled in the relevant art will appreciate that the concepts of the invention can be used in various environments other than location based environments or the Internet. In general, a display description may be in HTML, XML or WAP format, email format or any other format suitable for displaying information (including character/code-based formats, algorithm-based formats (e.g., vector generated), and bitmapped formats). Also, various communication channels, such as local area networks, wide area networks, or point-to-point dial-up connections, may be used instead of the Internet. The system may be conducted within a single computer environment, rather than a client/server environment. Also, the user computers may comprise any combination of hardware or software that interacts with the server computer, such as television-based systems and various other consumer products through which commercial or noncommercial transactions can be conducted. The various aspects of the invention described herein can also be implemented in or for an e-mail environment.

EXAMPLES OF CUSTOMER KIOSK FUNCTIONALITY

[0065] FIGS. 7A-G illustrate a series of screen displays **700a-g** with which a customer can invent a unique blend of different foods, place an order for the blend, store the blend for later recall, and/or retrieve and order a previously stored blend. In the illustrated embodiment, the screen displays **700a-g** relate to cereal blends and associated toppings. In other embodiments, however, the screen displays **700a-g** and/or variations thereof can be used to invent and order other food combinations. In one embodiment, the screen

displays **700** can be implemented with the interactive kiosk **148** described above with reference to FIG. 1. In other embodiments, all or a portion of the screen displays **700** can be implemented with a different computer system, such as a personal computer located in a customer’s home or office which accesses the screen displays via a web server computer.

[0066] FIG. 7A illustrates a screen display **700a** that enables a customer to select an existing cereal blend or create his or her own unique cereal blend (i.e., “invent-a-blend”). For example, the customer can select a first button **702a** to select an existing cold cereal blend, or a second button **702b** to select an existing hot cereal blend. Alternatively, the customer can select a third button **702c** to create a cold cereal blend, or a fourth button **702d** to create a hot cereal blend. On the other hand, if the customer instead preferred a parfait, he or she can select a fifth button **702e** to create a parfait.

[0067] If the customer has used the kiosk **148** before to remotely create and/or order a menu item, the customer can select a sixth button **702f**. This button brings up another screen display (not shown) which lists the customer’s earlier creations. The customer can then select an earlier creation, and an order for that creation will be immediately transmitted to a remote operator (e.g., an employee of the QSR **100** of FIG. 1) for preparation.

[0068] If the customer desires to change a selection on the screen display **700a**, the customer can do so by selecting a “Start Over” button **703**. Once the customer has made his or her final selection from the screen display **700a**, the customer can select a “Next” button **704** to proceed with the ordering process. For example, if the customer selects the third button **702c** to “Create a COLD cereal blend” and then selects the Next button **704**, this brings up the screen display **700b** illustrated in FIG. 7B.

[0069] The screen display **700b** enables the customer to select a quantity of cereal for purchase. For example, the user can select a first button **712a** to order a “Bowl” (i.e., two scoops of cereal, one topping/mix-in, and choice of milk). Alternatively, the user can select a second button **712b** for a “Kid’s Bowl” (i.e., one scoop of cereal and choice of milk), a third button **712c** for a bowl of “Cereality Granola,” and a fourth button **712d** for a “Cereal Box” (i.e., 8 scoops of cereal). The customer can select a “Back” button **716** to return to the previous screen and change a portion of the order. After selecting the desired order size from the screen display **700b**, the customer can select a “Next” button **714** to proceed with the ordering process. For example, if the customer selects the first button **712a** to order a Bowl, this brings up the screen display **700c** illustrated in FIG. 7C.

[0070] The screen display **700c** enables the customer to select from multiple different, competitively-branded cereals to fill his or her Bowl. In the illustrated embodiment, the customer is allowed to select two scoops of cereal because he or she previously selected “Bowl” as the desired serving size, and a Bowl includes two scoops of cereal. The first cereal selection is made using a first group of selector buttons **722a**, and the second selection is made using a second group of selector buttons **722b**. An “Up” button **728a** allows the customer to scroll up through the list of different cereals, and a corresponding “Down” button **728b** lets the customer scroll down through the list. After the customer has

US 2005/0160005 A1

Jul. 21, 2005

7

selected the desired cereals, the customer can select a “Next” button **726** to proceed to the screen display **700d** illustrated in **FIG. 7D**.

[0071] The screen display **700d** enables the customer to select one or more toppings. Each of a multiple different toppings (e.g., almonds, raisins, bananas, etc.) is associated with a corresponding button **732**. The customer can select a topping by clicking on the appropriate button. The customer can view additional toppings by selecting either a “Previous Toppings” button **738a** or a “More toppings” button **738b**. After one or more toppings have been selected, the customer can select a “Next” button **734** to proceed to the screen display **700e** illustrated in **FIG. 7E**. Although the screen displays **700c** and **700d** of the illustrated embodiment include textual descriptions of the various cereals and toppings available, both of these screen displays can also or instead include graphics describing various aspects (e.g., brands, logos, etc.) of the offerings.

[0072] The screen display **700e** enables the customer to complete his or her order. In the illustrated embodiment, the customer’s order is displayed on the screen. After checking the order, the customer can select a Send button **742** to automatically send the order to a remote operator (e.g., an employee at a Point-of-Sale counter of the QSR **100**) for preparation. Alternatively, the user can select a Send/Save button **744** that will additionally save the customer’s order in an associated database from which the user can retrieve the order at a later date. On the other hand, if the customer desires to just save the order without placing it at this time, the customer can do so by selecting a Save button **746**. Selecting either the Send/Save button **744** or the Save button **746** automatically brings up the screen display **700f** illustrated in **FIG. 7F**.

[0073] The screen display **700f** enables the customer to enter a unique code that will be associated with the customer’s saved order. In this regard, the screen display **700f** includes a graphical representation of a keyboard **752** with which the customer can enter a User ID in a display field **756**. Once this has been done, the customer can select a “Next” button **754** to proceed to the screen display **700g** illustrated in **FIG. 7G**. The screen display **700g** is generally similar in structure and function to the display screen **700f**, and can be used by the customer to enter a unique Password in a display field **766** in a similar manner. In the illustrated embodiment, the Password is used in conjunction with the User ID to ensure that only the originating customer has access to his or her stored orders.

[0074] The interactive kiosk **148** illustrated in **FIG. 1**, and the related screen displays **700a-g** described above with reference to **FIGS. 7A-7G**, can be utilized in one embodiment as follows. First, a customer approaches the kiosk **148** and inputs his or her order (e.g., a combination of various cereals and toppings) in the manner described above with reference to **FIGS. 7A-7G**. Once the customer has input the order, the order is automatically transmitted to an output device (e.g., a point-of-sale device) located at the service bar **110** (**FIG. 1**). In one embodiment, the output device can include a paper printer that outputs a printed recipe for the desired food combination. At this time, one of the QSR staff (e.g. a “Cerealologist”) can prepare the order based on the printed output. In this manner, the Cerealologist can be preparing the customer’s order as the customer makes their

way from the kiosk **148** to the check-out station **114** (**FIG. 1**). When the customer arrives, their order is ready to go. In this embodiment, the customer can pay for the order at the check-out station **114**. In another embodiment, however, the customer can pay for the order at the kiosk **148** via suitable payment functionality (e.g., a credit card reader, a bill and/or coin slot, a user interface configured to receive a customer account no., etc.)

[0075] In another embodiment, the kiosk **148** can transmit the customer’s order to a automatic food-preparing apparatus (not shown) instead of a point-of-sale device. In one aspect of this embodiment, the food-preparing apparatus can be configured to automatically prepare the customer’s order in response to receiving an appropriate signal from the kiosk **148**. In addition, in this embodiment the apparatus can also package the customer’s order and dispense it proximate to the point-of-sale.

[0076] The kiosk **148** can also be configured to provide customers with recommended menu items and combinations, and nutritional information about various menu choices. For example, in one embodiment, the kiosk **148** can provide customers with recommended menu items tailored to fit specified dietary and/or nutritional preferences or restrictions.

EXAMPLES OF POINT-OF-SALE DEVICE FUNCTIONALITY

[0077] **FIGS. 8A-8D** illustrate various point-of-sale screen displays **810a-d** configured in accordance with an embodiment of the invention. In this embodiment, the screen displays **810a-d** can be presented in sequential order to a point-of-sale staff or cashier to facilitate taking a customer’s order at the QSR **100** described above with reference to **FIG. 1**. In **FIG. 8A**, a screen display **810a** lists various food product options available to the customer. These options can include, for example, one or two scoops of a particular type of cereal, fruit toppings, cereal bars, parfaits, liquids to mix with the cereal (e.g., milk, soy, etc.), and drinks such as coffee and tea. If the cashier selects a “2 SCOOP” button **802**, the screen display **810b** of **FIG. 8B** is displayed.

[0078] As **FIG. 8B** illustrates, the screen display **810b** includes a list of cereals from which the customer can choose. If, for example, the customer tells the cashier that he or she desires Apple Jacks and Golden Grahams, then the cashier accordingly selects an “Apple Jacks” button **806** and a “Golden Grahams” button **808**. Doing so generates the display screen **810c** illustrated in **FIG. 8C**.

[0079] The display screen **810c** illustrates the various types of fruit and other toppings available. In this particular embodiment, one topping is free with a two scoop cereal order. If, for example, the customer desires dried apples, the cashier selects a “Dried Apple” button **812**. This selection generates the screen display **810d** illustrated **FIG. 8D**. The display screen **810d** shows the cashier the customer’s order and the associated price.

EXAMPLE OF A ROUTINE FOR RECEIVING DATA

[0080] **FIG. 9** is a flow diagram of a routine **900** for receiving customer point-of-sale data in accordance with an embodiment of the invention. In block **902**, the routine **900**

US 2005/0160005 A1

Jul. 21, 2005

8

receives raw point-of-sale data from customers. In one embodiment, the raw data can include information about customers' eating habits. For example, the raw data can include information about the types of branded food products (e.g., what types of cereals and cereal combinations) the customers order, the types of other food products (e.g., breakfast cereals, breakfast bars, smoothies, etc.) the customers order, the time when customers place their orders, the quantities of products ordered, as well as other useful information.

[0081] In block 904, the raw data received in block 902 is analyzed or "mined." In this embodiment, the data can be mined to determine particular customer trends, such what types of independently-branded food products (e.g., cereals, cereal combinations, toppings, etc.) customers desire. The data can be mined to provide other information as well, including, for example, marketing approaches, product offerings (e.g., different "premixed" product offerings), and bulk quantities of particular items to warehouse in view of customer demand.

[0082] In block 906, the routine 900 packages the point-of-sale data in reports and/or other useful forms for use by QSR operators and other entities. For example, in one embodiment, this data can be provided to bulk product suppliers (e.g., cereal manufacturers) for use in determining what types of products to offer the home consumer as well as particular marketing strategies. After block 906, the routine 900 is complete.

[0083] Unless the context clearly requires otherwise, throughout the foregoing description and the associated examples, the words "comprise," "comprising," and the like are to be construed in an inclusive sense, as opposed to an exclusive or exhaustive sense; that is to say, in the sense of "including, but not limited to." Additionally, the words "herein," "above," "below," and words of similar import, when used in this application, shall refer to this application as a whole and not to any particular portions of this application. When the claims use the word "or" in reference to a list of two or more items, that word covers all of the following interpretations of the word: any of the items in the list, all of the items in the list, and any combination of the items in the list.

[0084] The above detailed description of various embodiments of the invention is not intended to be exhaustive or to limit the invention to the precise form disclosed. While specific embodiments of, and examples for, the invention are described above for illustrative purposes, various equivalent modifications are possible within the scope of the invention, as those skilled in the relevant art will recognize. For example, while processes or blocks are presented in a given order, alternative embodiments may perform routines having steps, or employ systems having blocks, in a different order, and some processes or blocks may be deleted, moved, added, subdivided, combined, and/or modified. Each of these processes or blocks may be implemented in a variety of different ways. Also, while processes or blocks are at times shown as being performed in series, these processes or blocks may instead be performed in parallel, or may be performed at different times. Where the context permits, words in the above Detailed Description using the singular or plural number may also include the plural or singular number respectively.

[0085] The teachings of the invention provided herein can be applied to systems other than the system described herein. Similarly, the elements and acts of the various embodiments described above can be combined to provide further embodiments.

[0086] All of the above patents and applications and other references, including any that may be listed in accompanying filing papers, are incorporated herein by reference. Aspects of the invention can be modified, if necessary, to employ the systems, functions, and concepts of the various references described above to provide yet further embodiments of the invention.

[0087] These and other changes can be made to the invention in light of the above Detailed Description. While the above description details certain embodiments of the invention and describes the best mode contemplated, no matter how detailed the above appears in text, the invention can be practiced in many ways. As noted above, particular terminology used when describing certain features or aspects of the invention should not be taken to imply that the terminology is being redefined herein to be restricted to any specific characteristics, features, or aspects of the invention with which that terminology is associated. Accordingly, the actual scope of the invention encompasses not only the disclosed embodiments, but also all equivalent ways of practicing or implementing the invention.

[0088] From the foregoing, it will be appreciated that specific embodiments of the invention have been described herein for purposes of illustration, but that various modifications may be made without deviating from the spirit and scope of the invention. For example, aspects of the invention described in the context of particular embodiments may be combined or eliminated in other embodiments. Further, while advantages associated with certain embodiments of the invention have been described in the context of those embodiments, other embodiments may also exhibit such advantages, and not all embodiments need necessarily exhibit such advantages to fall within the scope of the invention. Accordingly, the invention is not limited, except as by the appended claims.

[0089] While certain aspects of the invention are presented below in certain claim forms, the inventors contemplate the various aspects of the invention in any number of different claim forms. For example, while one or more aspects of the invention may be recited as embodied in a computer-readable medium, other aspects may likewise be embodied in a computer-readable medium. Accordingly, the inventors reserve the right to add additional claims after filing the application to pursue such additional claim forms for other aspects of the invention.

[0090] While certain aspects of the invention are presented below in certain claim forms, the inventors contemplate the various aspects of the invention in any number of different claim forms. For example, while one or more aspects of the invention may be recited as embodied in a computer-readable medium, other aspects may likewise be embodied in a computer-readable medium. Accordingly, the inventors reserve the right to add additional claims after filing the application to pursue such additional claim forms for other aspects of the invention.

US 2005/0160005 A1

Jul. 21, 2005

9

1. A method of providing breakfast cereal in a quick-serve restaurant setting, the method comprising:

displaying to customers retail-sale packages for multiple competitively-branded breakfast cereals, wherein the multiple competitively-branded breakfast cereals are manufactured by at least two different cereal manufacturers;

receiving a request from a customer for a first portion of a first one of the competitively-branded breakfast cereals and a second portion of a second one of the competitively-branded breakfast cereals;

in response to receiving the request from the customer, combining the first and second portions of the first and second competitively-branded breakfast cereals together in a carry-out container; and

presenting the carry-out container to the customer in exchange for payment.

2. The method of claim 1 wherein displaying multiple retail-sale packages includes displaying multiple brand-name cereal boxes in over-the-counter cabinets having front doors that are at least partially transparent.

3. The method of claim 1 wherein receiving a request from a customer includes receiving a request for a first portion of a first cereal from a first cereal manufacturer and a second portion of a second cereal from a second, different cereal manufacturer.

4. The method of claim 1 wherein receiving a request from a customer includes receiving a request for a first portion of a first cereal from a first cereal manufacturer, a second portion of a second cereal from a second cereal manufacturer, and a portion of a topping.

5. The method of claim 1 wherein combining the first and second portions of the breakfast cereals together in a carry-out container includes retrieving the first portion of breakfast cereal from a first storage bin, retrieving the second portion of breakfast cereal from a second storage bin, and combining the first and second portions together in view of the customer.

6. The method of claim 1 wherein combining the first and second portions of the breakfast cereals together in a carry-out container includes placing first and second portions of brand-name cereal in a leak-proof, paperboard container.

7. The method of claim 1 wherein combining the first and second portions of the breakfast cereals together in a carry-out container includes placing first and second portions of brand-name cereal in a paperboard container having a generally circular base portion and a generally square top portion.

8. The method of claim 1 wherein combining the first and second portions of the breakfast cereals together in a carry-out container includes placing first and second portions of brand-name cereal in a paperboard container having a generally circular base portion and a generally square top portion having at least two closable flaps.

9. The method of claim 1, further comprising, in response to receiving the request from the customer, recording information related to the request in a database, the information including at least the brand names of the first competitively-branded cereal and the second competitively-branded cereal.

10. The method of claim 1, further comprising, in response to receiving the request from the customer, recording information related to the request in a database, the

information including at least the time of the request and brand names of the first competitively-branded cereal and the second competitively-branded cereal.

11. The method of claim 1, further comprising, in response to receiving the request from the customer, recording information related to the request in a database, the information including at least a first quantity of the first portion of the first competitively-branded cereal and a second quantity of the second portion of the second competitively-branded cereal.

12. The method of claim 1, further comprising providing a menu having at least one menu item composed of the first competitively-branded cereal and the second competitively-branded cereal combined together in the carry-out container.

13. The method of claim 1, further comprising providing a menu having at least one menu item composed of multiple customer-selectable, competitively-branded cereals combined together in the carry-out container.

14. The method of claim 1, further comprising providing a menu having at least one menu item composed of multiple customer-selectable, competitively-branded cereals combined together in the carry-out container with a topping of the customer's choosing.

15. A method of providing food in a retail setting, the method comprising:

displaying retail-sale packages for multiple competitively-branded, single food category, packaged food products;

receiving a request from a customer for a first portion of a first one of the competitively-branded, packaged food products and a second portion of a second one of the competitively-branded, packaged food products;

in response to receiving the request from the customer, placing the first and second portions of the competitively-branded, packaged food products together in a container; and

presenting the container to the customer.

16. The method of claim 15 wherein displaying retail-sale packages includes positioning the retail-sale packages near a service bar in view of the customer, and wherein placing the first and second portions of the competitively-branded, packaged food products together in a container includes retrieving a first portion of the first product from a first storage bin positioned near the service bar, retrieving a second portion of the second product from a second storage bin positioned near the service bar, and combining the first and second portions together in view of the customer.

17. The method of claim 15 wherein placing the first and second portions of the competitively-branded, packaged food products together in a container includes placing the first and second portions together in a leak-proof, paperboard carry-out container.

18. The method of claim 15 wherein receiving a request from a customer includes receiving an order from a stand-alone kiosk with which the customer placed the order.

19. The method of claim 15 wherein receiving a request from a customer includes receiving an order from a stand-alone kiosk having user interface with which the customer manually placed the order.

20. The method of claim 15, further comprising, in response to receiving the request from the customer, recording information related to the request in a database, the

US 2005/0160005 A1

Jul. 21, 2005

10

information including at least the name of the first competitively-branded, packaged food product and the name of the second competitively-branded, packaged food product.

21. The method of claim 15, further comprising, in response to receiving the request from the customer, recording information related to the request in a database, the information including at least the name of the first competitively-branded, packaged food product, the name of the second competitively-branded, packaged food product, and the time of the request.

22. The method of claim 15, further comprising, in response to receiving the request from the customer, recording information related to the request in a database, the information including at least the quantity of the first competitively-branded, packaged food product and quantity of the second competitively-branded, packaged food product.

23. The method of claim 15, further comprising:

in response to receiving the request from the customer, recording information related to the request in a database; and

providing at least a portion of the recorded information to a third-party user.

24. The method of claim 15, further comprising:

in response to receiving the request from the customer, recording information related to at least one of the first competitively-branded, packaged food product and the second competitively-branded, packaged food product in a database; and

providing at least a portion of the recorded information to a manufacturer of at least one of the first competitively-branded, packaged food product and the second competitively-branded, packaged food product.

25. The method of claim 15, further comprising providing a menu having at least one menu item composed of the first competitively-branded, packaged food product and the second competitively-branded, packaged food product combined together in the container.

26. The method of claim 15, further comprising providing a menu having at least one menu item composed of multiple customer-selectable, competitively-branded packaged food products combined together in the container.

27. A retail restaurant method comprising:

providing a quick-serve restaurant having a front counter at a point-of-sale and signage behind the counter displaying a menu having multiple menu items, wherein a majority of entree food items on the menu include multiple independently branded food items in a same food category, wherein the independently branded food items are manufactured by at least two different manufacturers;

receiving from a walk-up customer a food order selected from the menu items, wherein the food order includes a designation by the customer of at least two different food items selected from the multiple independently branded food items;

preparing the order by combining a predetermined portion of each of the two different food items selected by the customer from the multiple independently branded food items; and

providing the order to the customer in exchange for payment.

28. The method of claim 27 wherein the food category is breakfast cereal, wherein boxes of independently branded breakfast cereal are displayed to the customer at or near the point-of-sale, and wherein an employee behind the counter wears a pajama top as part of a uniform for the retail restaurant.

29. The method of claim 27 wherein the food category is breakfast cereal, and wherein the method further comprises providing to the customer multiple different self-serve milk dispensers.

30. A computer-implemented system for placing a cereal order, the system comprising:

means for displaying a menu for viewing by a customer, the menu including at least one menu item composed of a first competitively-branded breakfast cereal combined with a second competitively-branded breakfast cereal;

means for receiving a customer selection identifying a first competitively-branded breakfast cereal and a second competitively-branded breakfast cereal; and

means for transmitting the customer selection for preparation.

31. The computer-implemented system of claim 30 wherein the means for displaying a menu are remote from the service bar.

32. The computer-implemented system of claim 30 wherein the means for receiving a customer selection include means for responding to a touch of the customer.

33. The computer-implemented system of claim 30 wherein the means for displaying a menu include means for listing brand names of multiple competitively-branded breakfast cereals.

34. The computer-implemented system of claim 30, further comprising:

means for combining a first portion of the first competitively-branded breakfast cereal with a second portion of the second competitively-branded breakfast cereal in a carry-out container in response to receiving the customer selection; and

means for delivering the carry-out container to the customer.

35. A method of providing food in a quick-serve food service setting, the method comprising:

providing to a customer a first portion of a first competitively-branded, dry food product in a take-out container, wherein the first competitively-branded, dry-food product is manufactured by a first manufacturer;

combining a second portion of a second competitively-branded, dry food product with the first portion of the first competitively-branded, dry food product in the take-out container, wherein the second competitively-branded, dry-food product is manufactured by a second manufacturer;

receiving payment from the customer in exchange for the take-out container with the combination of the first portion of the first competitively-branded, dry food product and the second portion of the second competitively-branded, dry food product; and

US 2005/0160005 A1

Jul. 21, 2005

11

wherein the payment is associated with a preset price for the take-out container with the combination of the first portion of the first competitively-branded, dry food product and the second portion of the second competitively-branded, dry food product.

36. The method of claim 35, further comprising displaying to the customer multiple competitively-branded, dry food products, wherein the competitively-branded, dry food products are from a single food category.

37. The method of claim 35 wherein providing to a customer a first portion of a first competitively-branded, dry food product includes providing a first cereal, and wherein combining a second portion of a second competitively-branded, dry food product with the first portion includes combining a second cereal with the first cereal.

38. A method of providing food in a quick-serve food service setting, the method comprising:

displaying to a customer multiple competitively-branded, dry food products, wherein the competitively-branded, dry food products are from a single food category;

providing to the customer a first portion of a first one of the competitively-branded, dry food products in a take-out container, wherein the first competitively-branded, dry-food product is manufactured by a first manufacturer;

combining a second portion of a second one of the competitively-branded, dry food products with the first portion of the first competitively-branded, dry food product in the take-out container, wherein the second competitively-branded, dry-food product is manufactured by a second manufacturer; and

receiving payment from the customer in exchange for the take-out container with the combined first and second portions of the first and second competitively-branded, dry food products.

39. The method of claim 38, further comprising providing to the customer a third portion of liquid to add to the combined first and second portions of the first and second competitively-branded, dry food products in the take-out container.

40. The method of claim 38 wherein the first competitively-branded, dry-food product includes a first cereal and the second competitively-branded, dry-food product includes a second cereal, and wherein the method further comprises providing to the customer a third portion of milk to add to the combined first and second portions of the first and second cereals in the take-out container.

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(12) **United States Patent**
Boland et al.

(10) **Patent No.:** **US 7,762,181 B2**
(45) **Date of Patent:** **Jul. 27, 2010**

(54) **CUSTOMISED NUTRITIONAL FOOD AND BEVERAGE DISPENSING SYSTEM**

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A47J 31/06 (2006.01)

(52) **U.S. Cl.** **99/322; 99/321**

(58) **Field of Classification Search** 99/275-277, 99/483, 485-489, 467-476, 279-323, 325-333, 99/357; 141/168-172, 83; 705/2-6, 45, 705/231; 600/300; 708/132; 222/1, 8, 28, 222/52, 145.5, 146.2, 144.5

See application file for complete search history.

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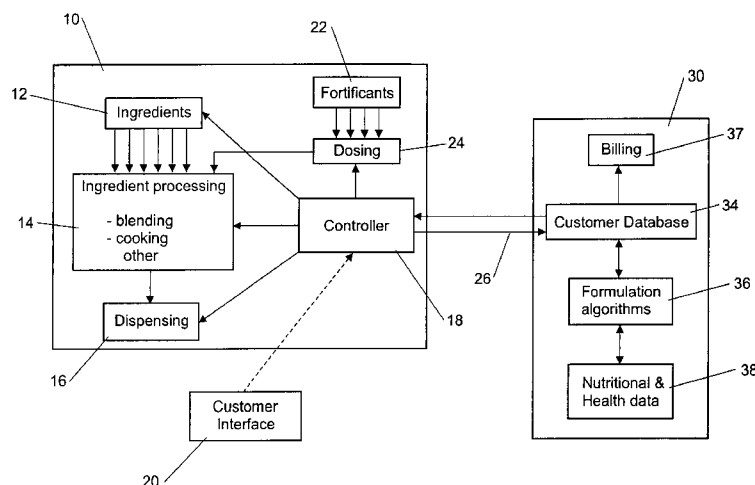
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(57) **ABSTRACT**

A system for dispensing a customized nutritional serving is made up of ingredients stored within a device incorporating the system. The device has a controller in whose memory is stored an inventory of the ingredients available in the device, their compositions and properties and customer profile data. The controller is programmed to formulate a serving which best matches the customized serving selected by the customer within constraints set by the programming taking into account the inventory of ingredients and the health profile of the customer. The customer is then presented with the selected serving and either accepts it or modifies it. The device is then programmed to prepare and dispense the final selection.

26 Claims, 14 Drawing Sheets



US 7,762,181 B2

Page 2

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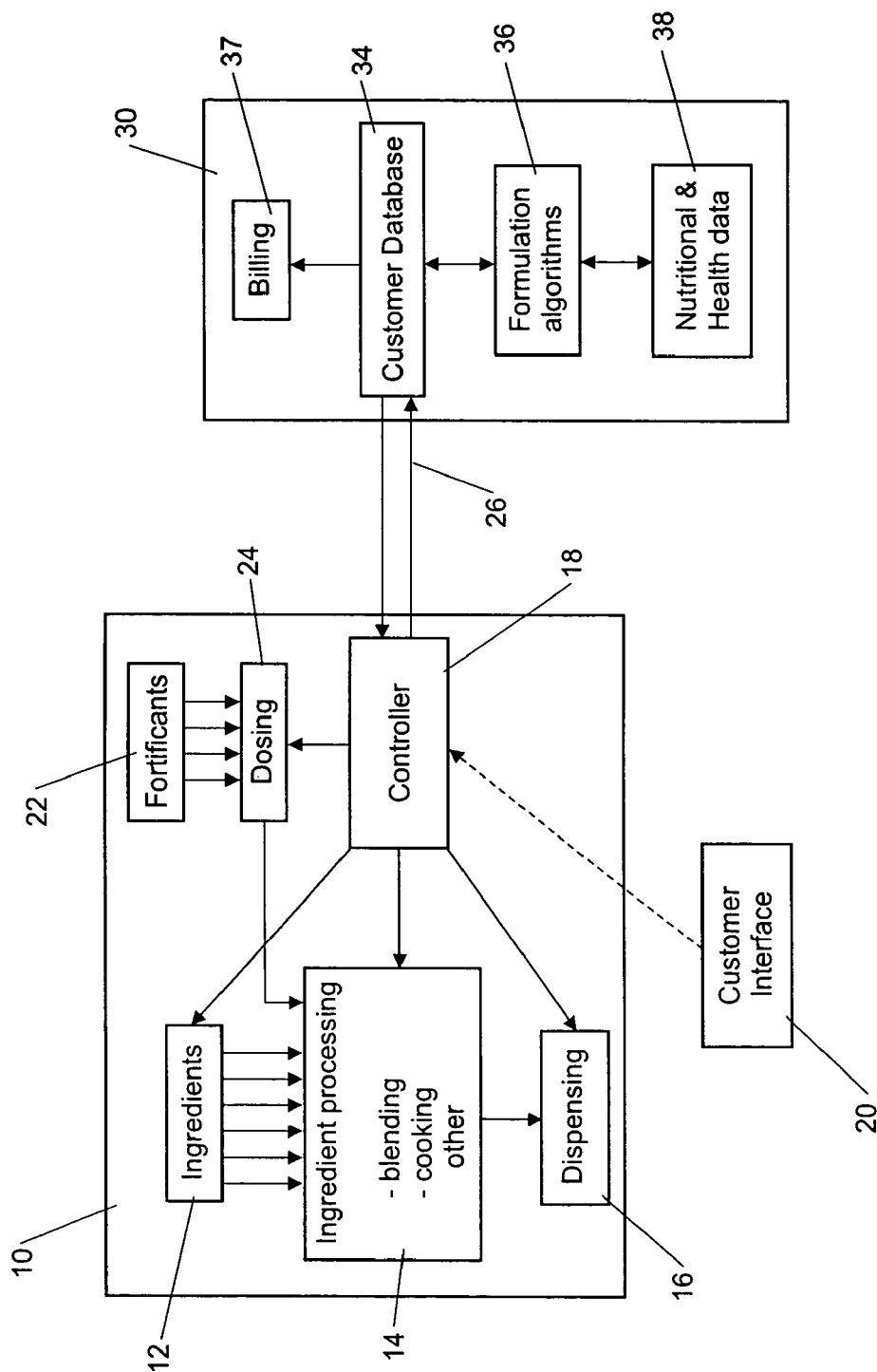


FIGURE 1

U.S. Patent

Jul. 27, 2010

Sheet 2 of 14

US 7,762,181 B2

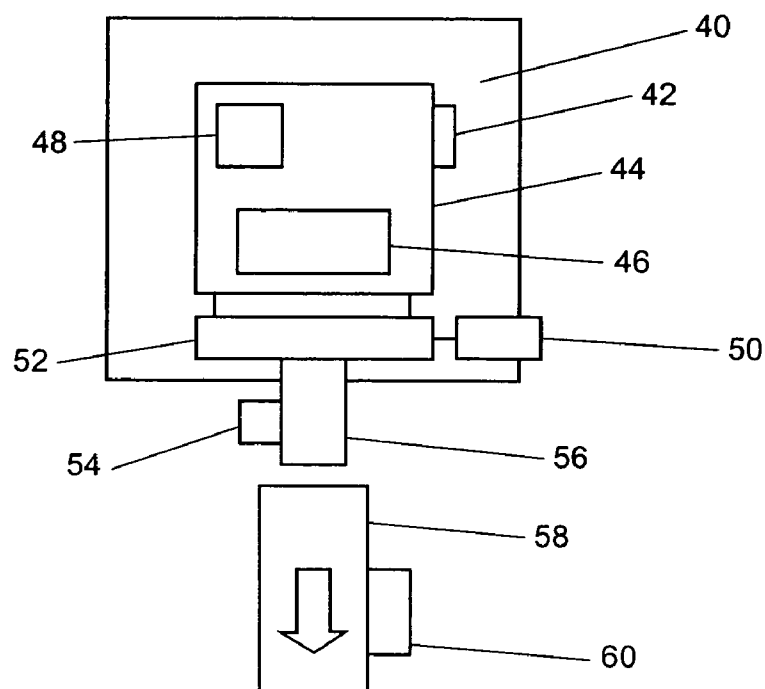


FIGURE 2

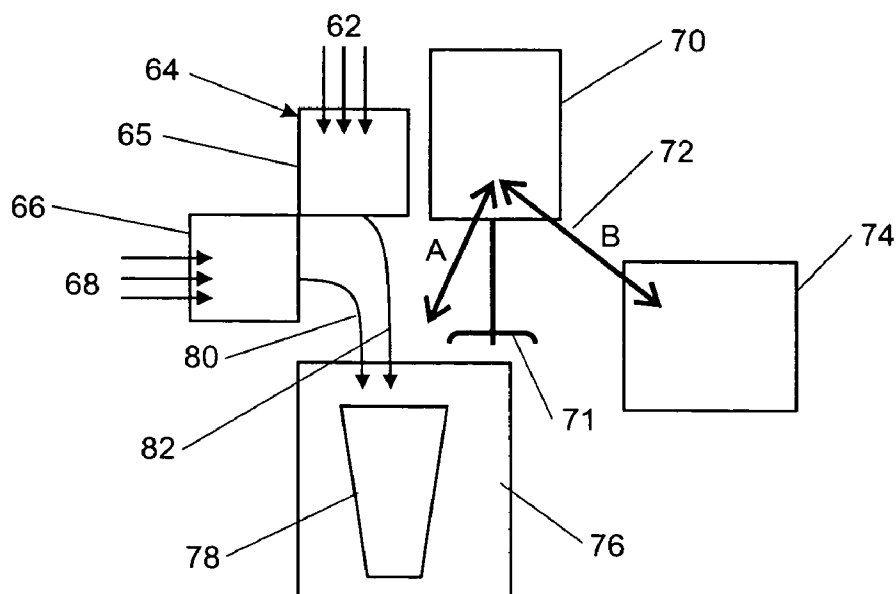


FIGURE 3

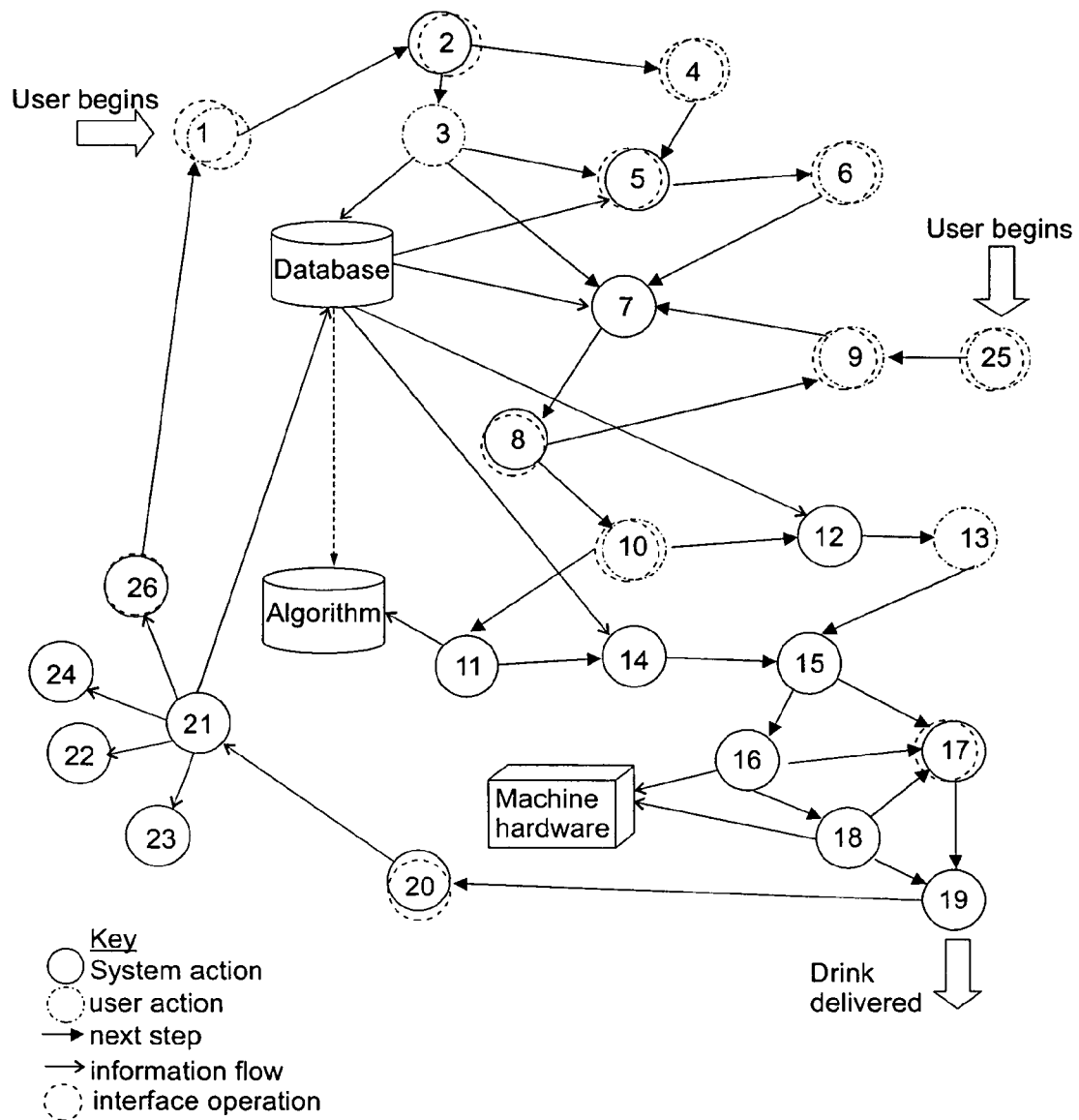


FIGURE 4

U.S. Patent

Jul. 27, 2010

Sheet 4 of 14

US 7,762,181 B2

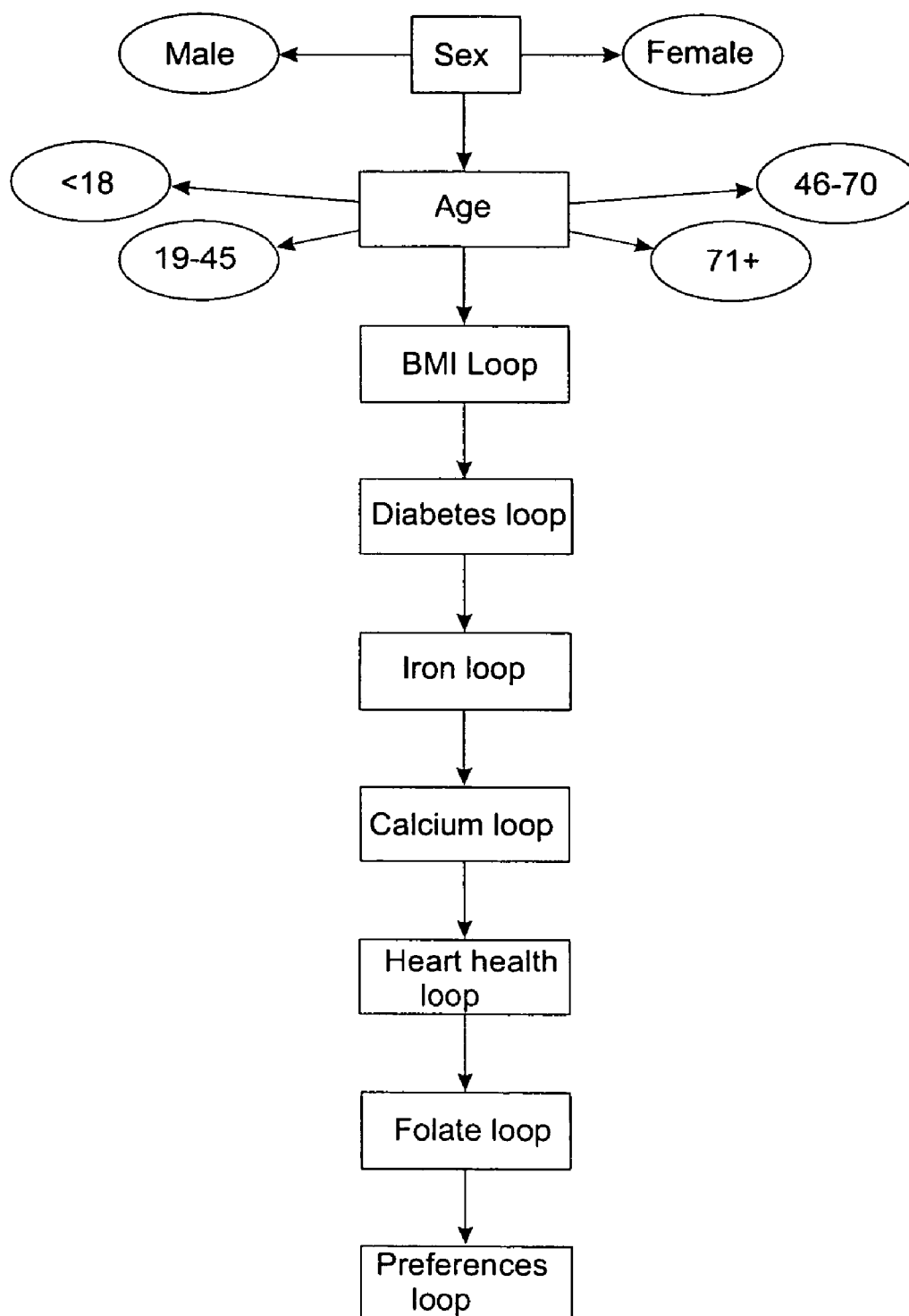


FIGURE 5

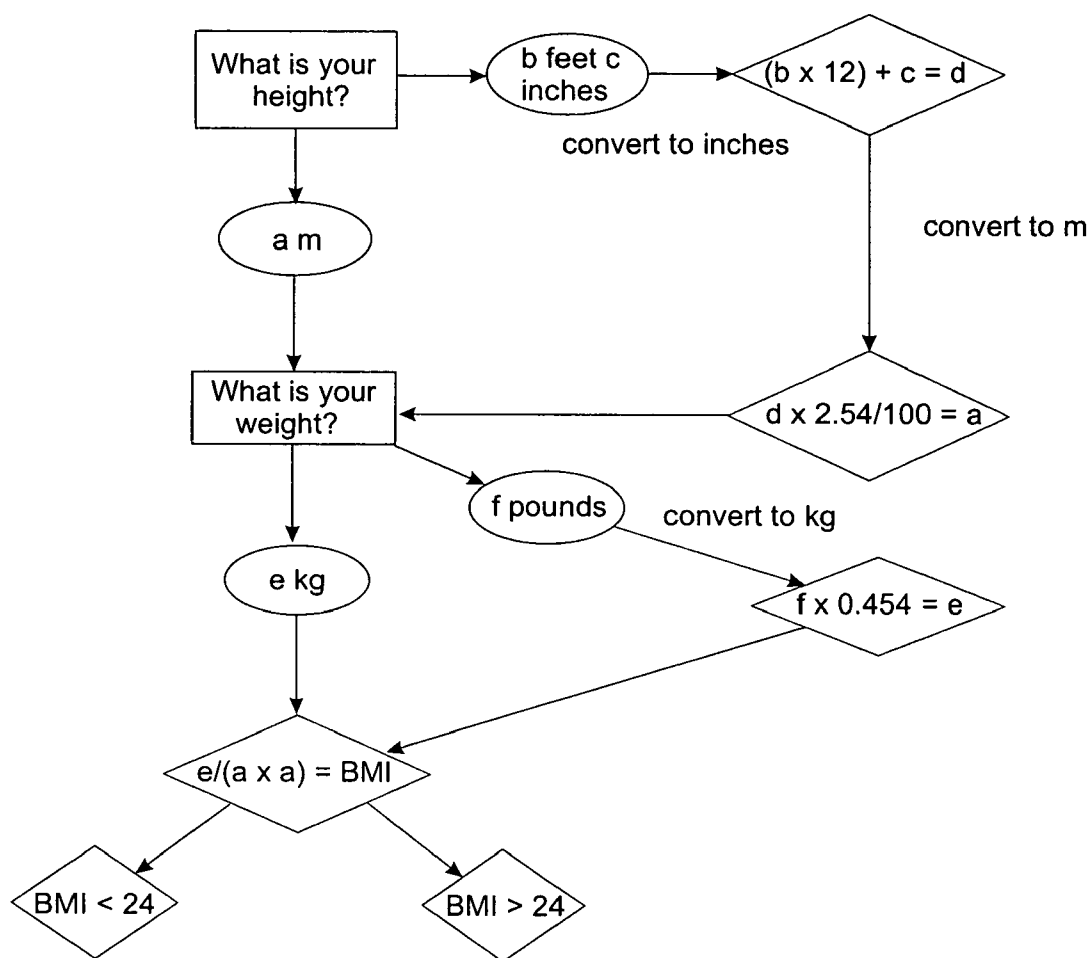


FIGURE 6

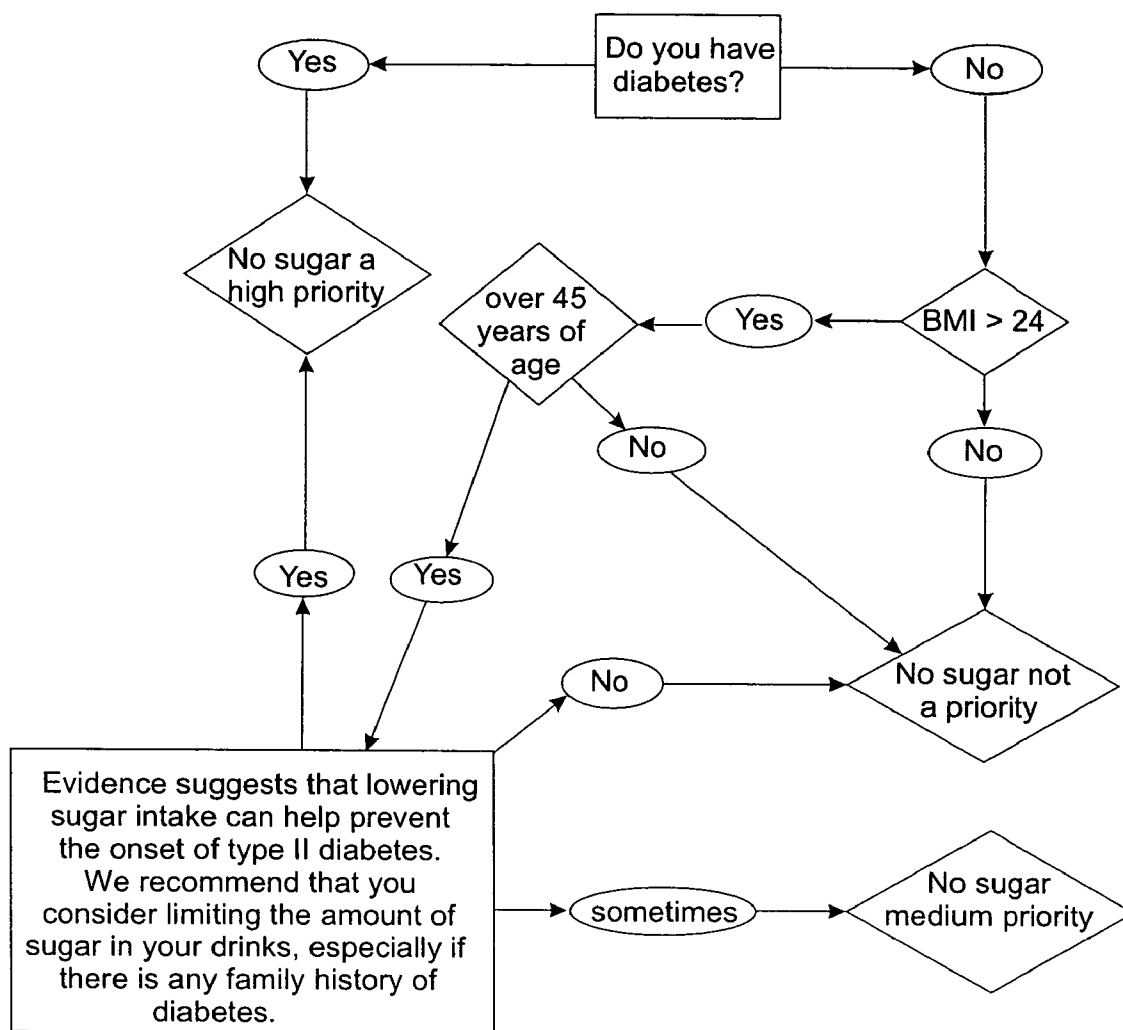


FIGURE 7

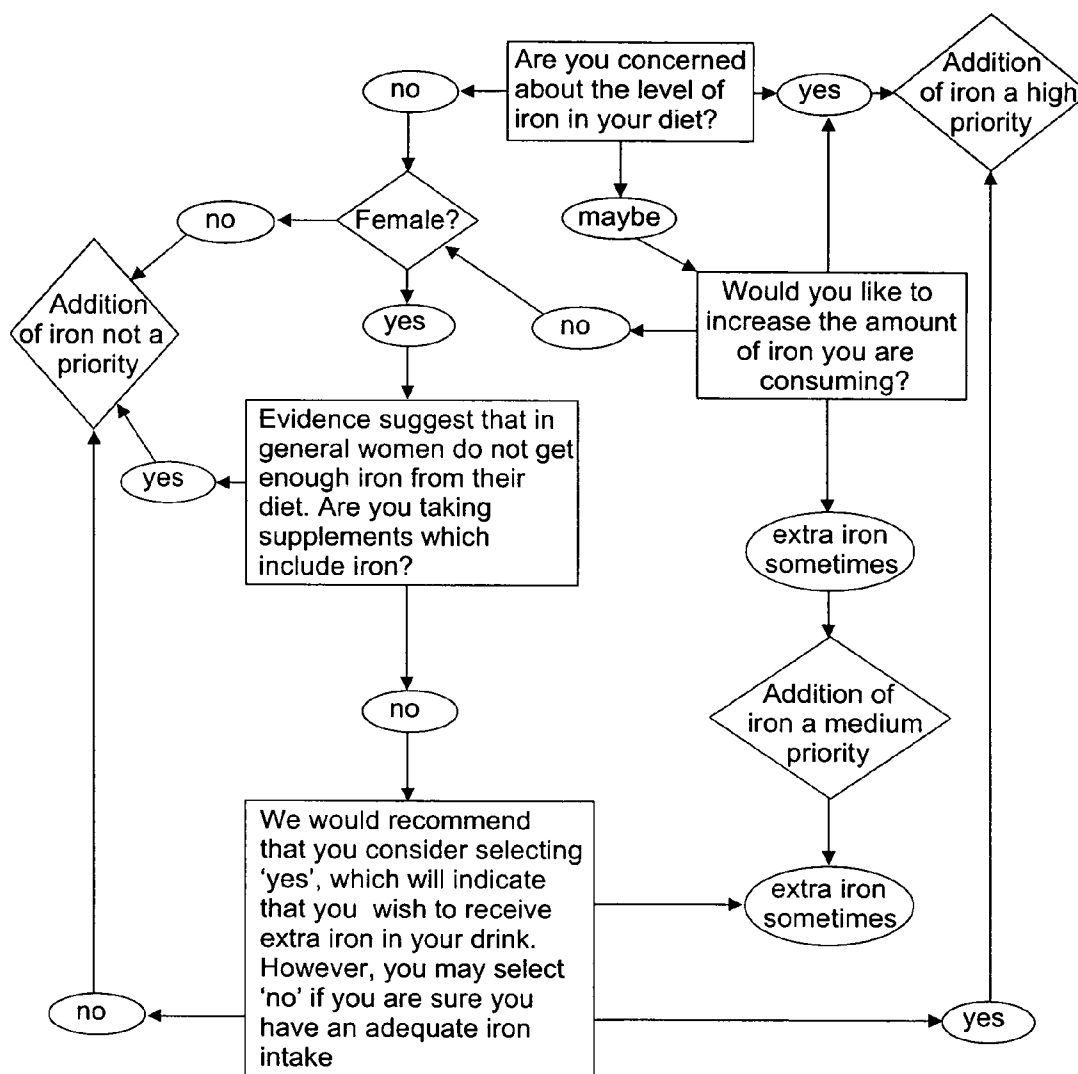


FIGURE 8

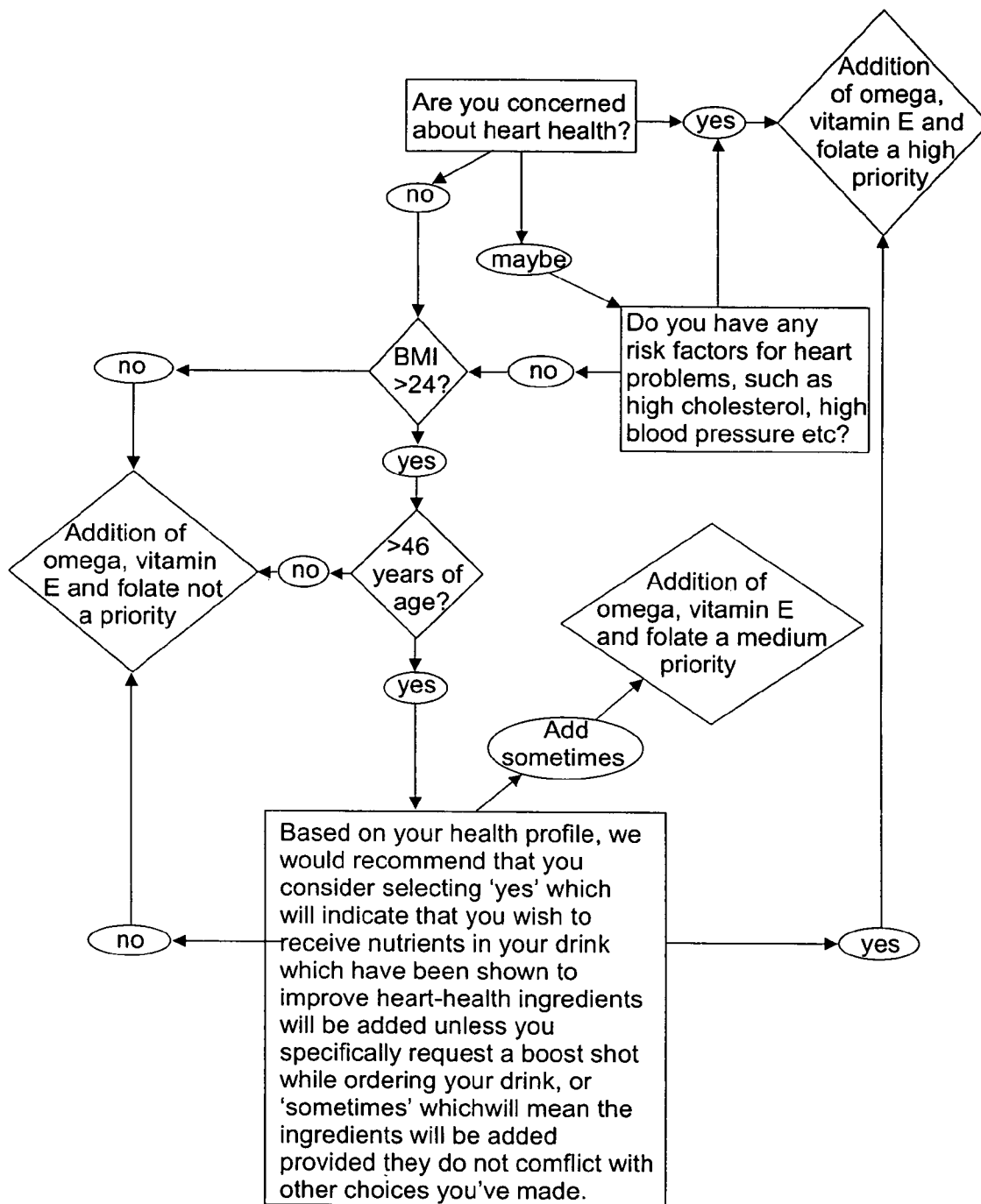


FIGURE 9

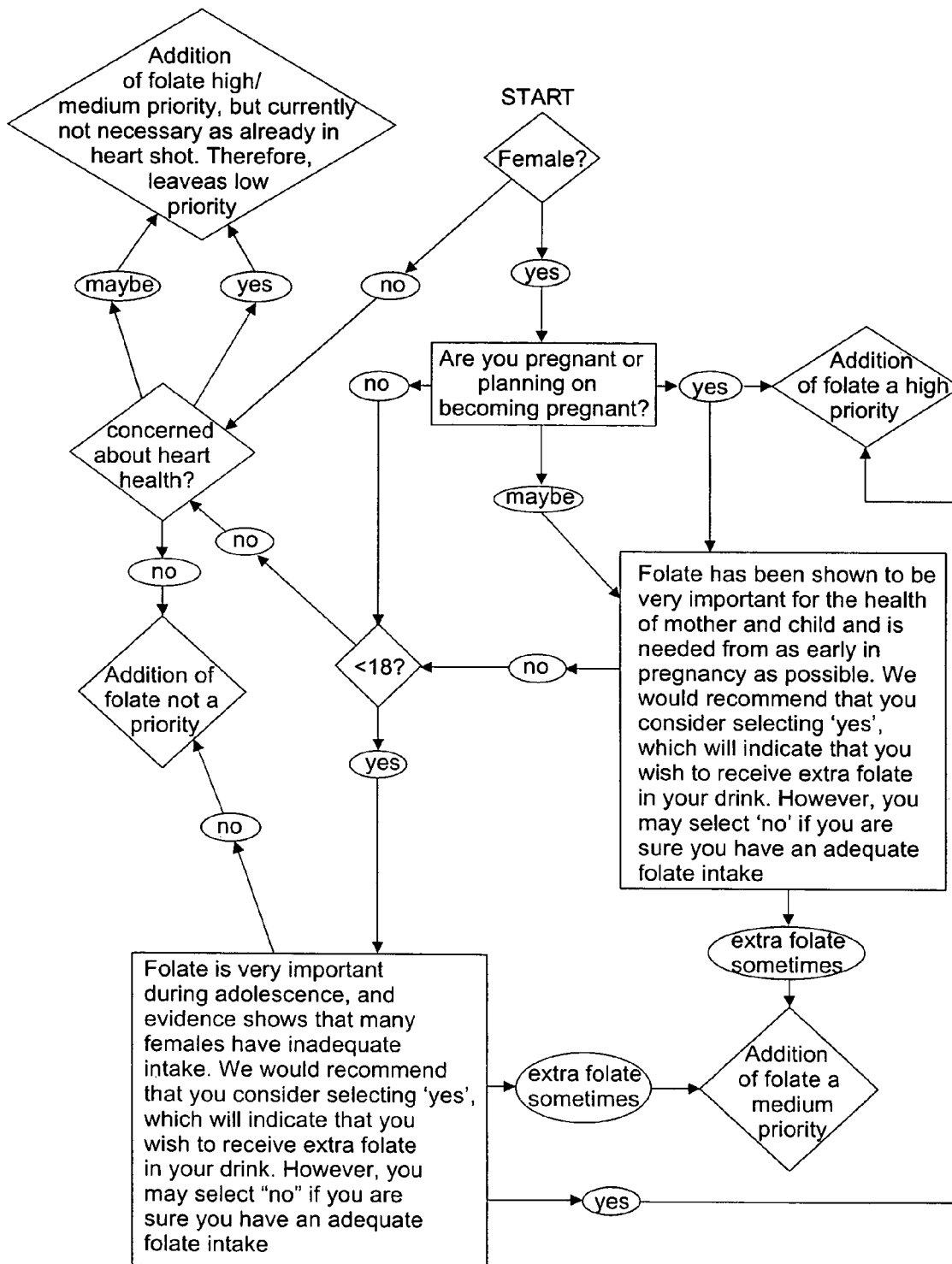


FIGURE 10

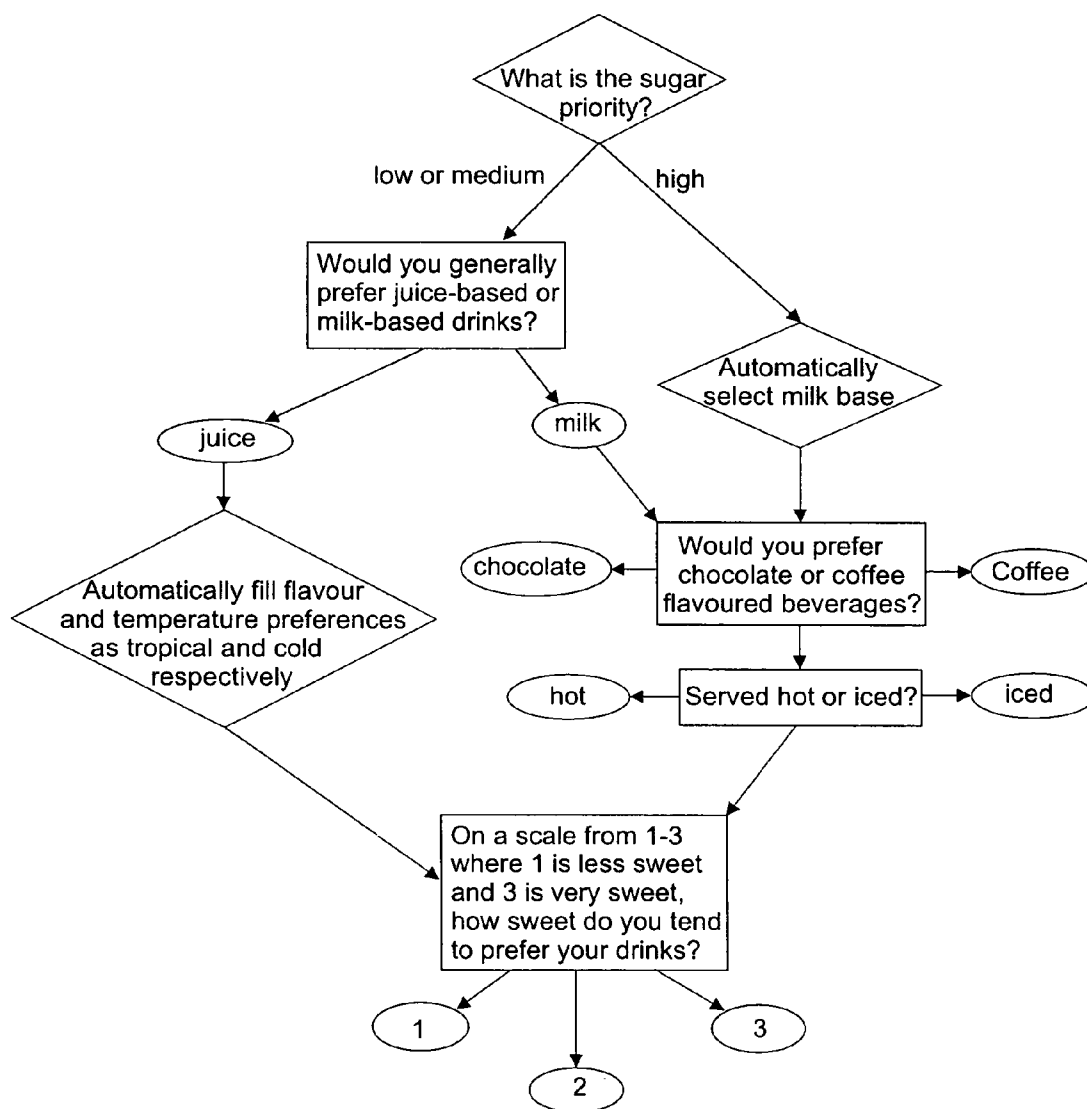


FIGURE 11

U.S. Patent

Jul. 27, 2010

Sheet 11 of 14

US 7,762,181 B2

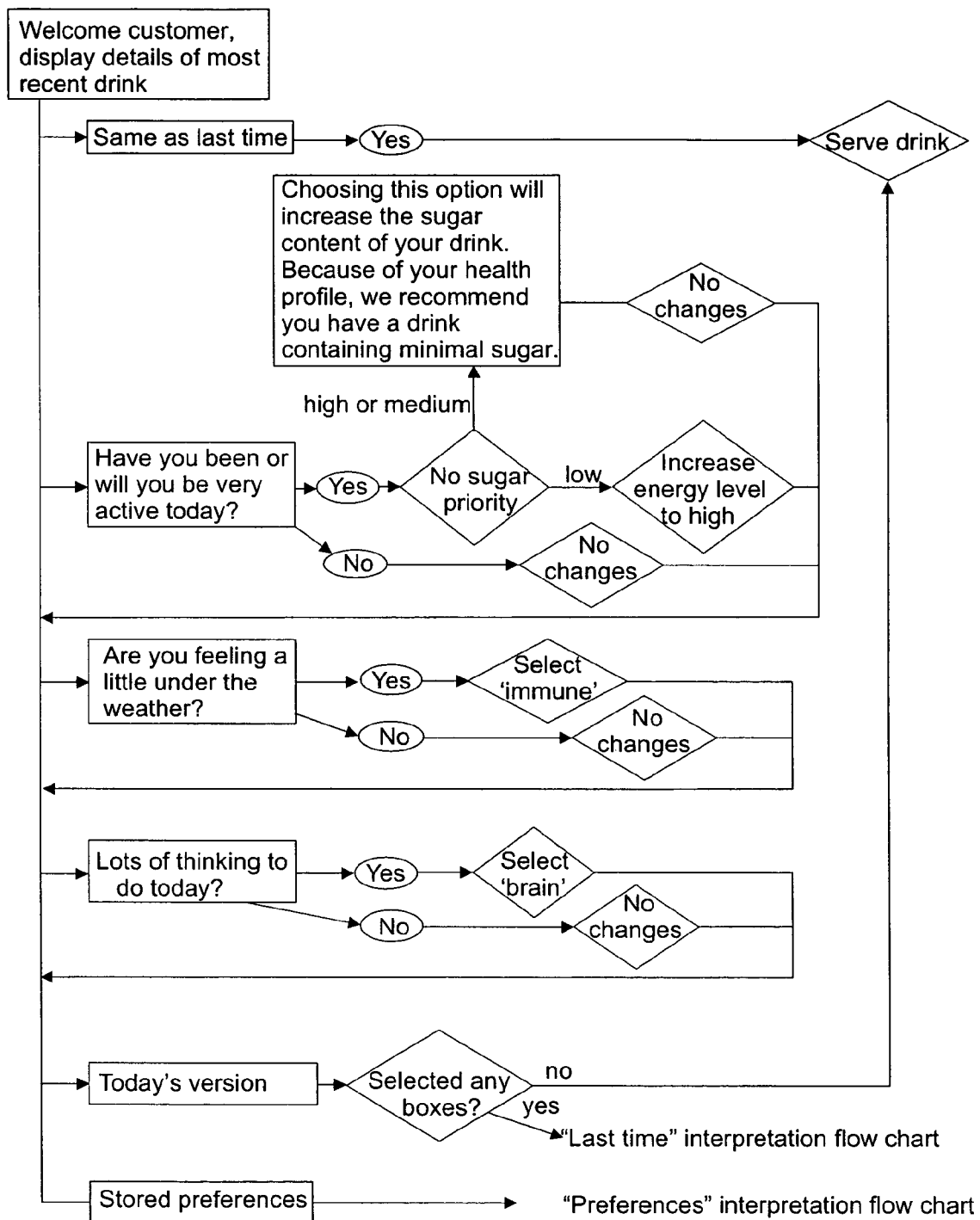


FIGURE 12

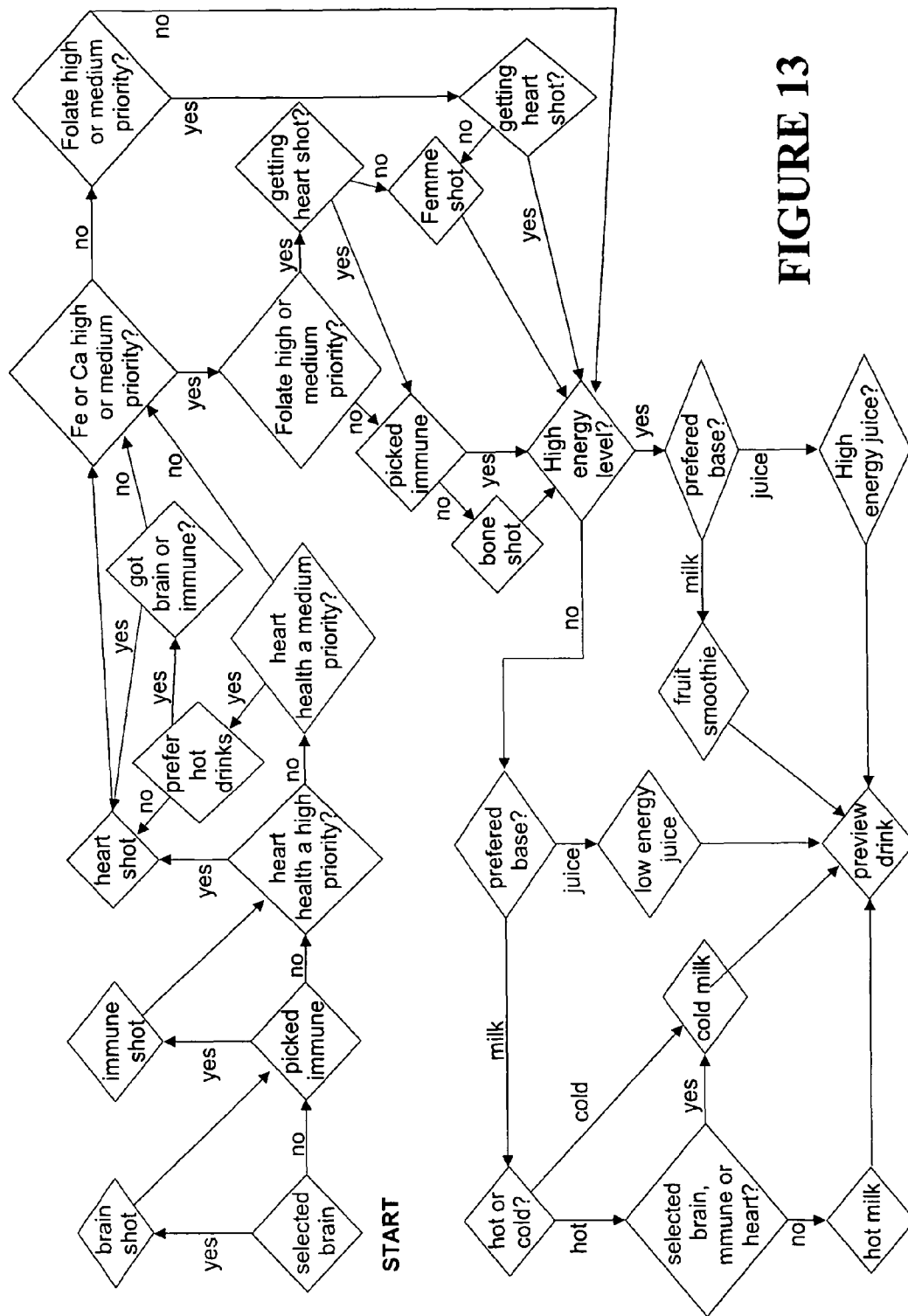


FIGURE 13

U.S. Patent

Jul. 27, 2010

Sheet 13 of 14

US 7,762,181 B2

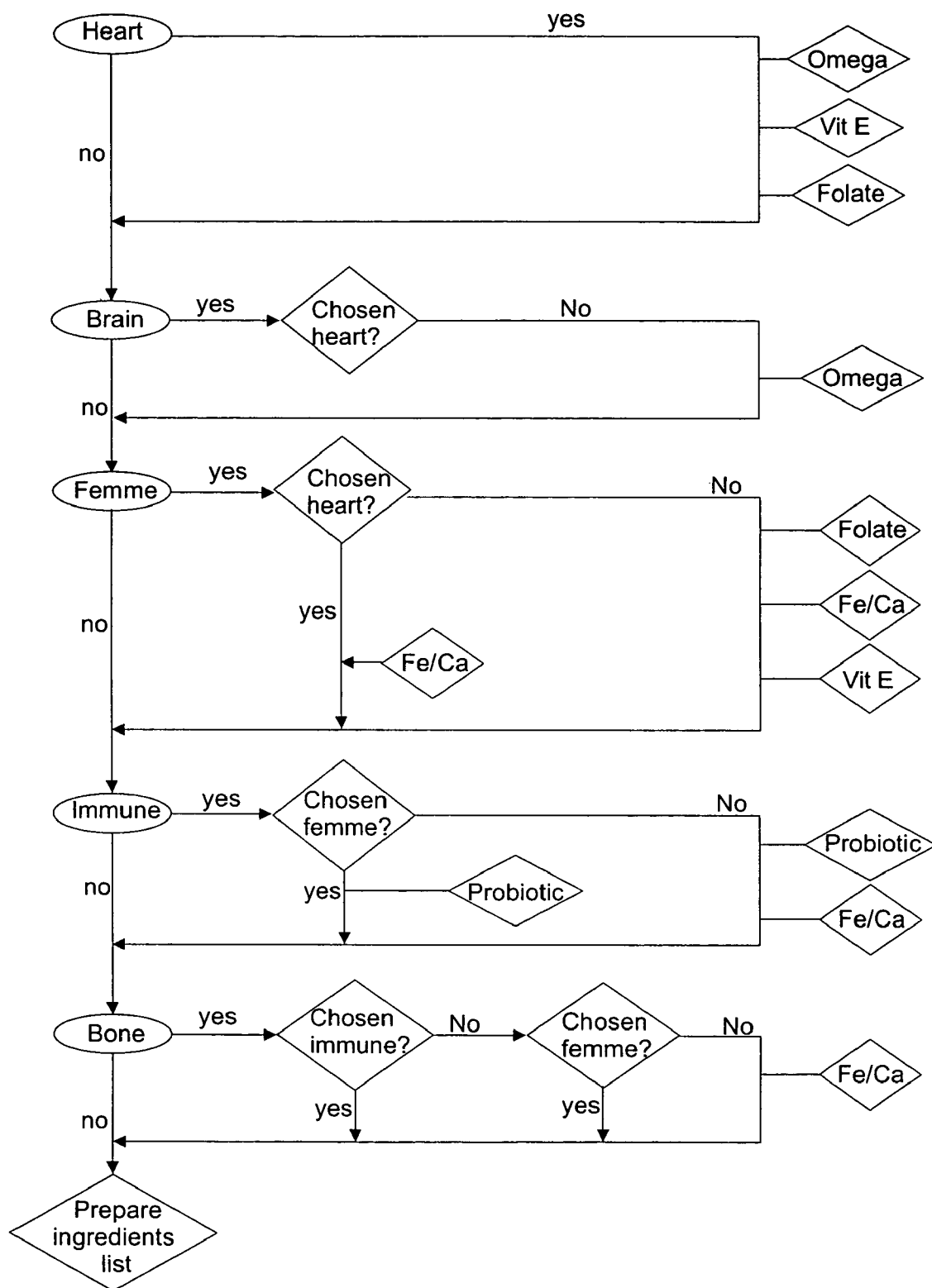


FIGURE 14

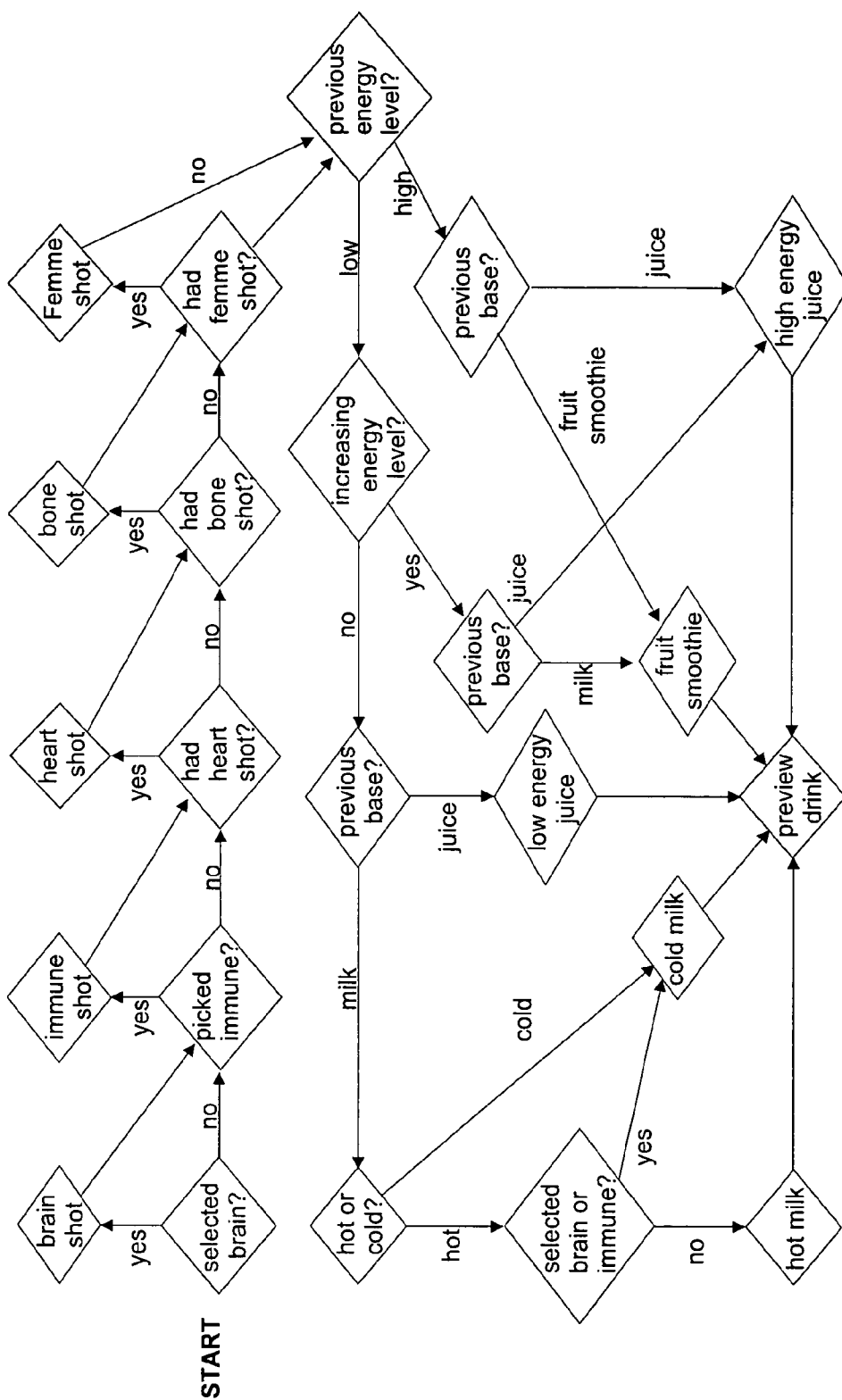


FIGURE 15

US 7,762,181 B2

1

CUSTOMISED NUTRITIONAL FOOD AND BEVERAGE DISPENSING SYSTEM

CROSS-REFERENCE TO RELATED APPLICATIONS

The present application claims priority to U.S. Provisional Application No. 60/615,444, filed Oct. 1, 2004, the disclosure of which is incorporated by reference herein.

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention relates to an automated food and beverage delivery system. More particularly it relates to an automated food and beverage delivery system which provides customized servings based on customer choice and stored customer profile, health and nutritional data.

2. Description of the Related Art

Vending machines which sell pre-packaged foods and beverages are known in the art. Vending machines are also known which dispense beverages such as coffee, hot chocolate or soft drinks where the customer selects the combinations and the machine dispenses each of the components from storage containers in measured amounts into a single receptacle which the customer removes from the machine.

In U.S. Pat. No. 5,404,796 there is described a vending machine which produces French fried potatoes from a dehydrated powder. The powder is rehydrated and the French fries formed in a die within the machine. The fries are then cooked in hot oil and dispensed freshly fried to the customer. The only capacity the device has for customisation is the choice of whether or not to dispense salt and/or a sauce.

Computer programs are known where the customer inputs a serving choice and the computer prepares a sample menu. This sample menu is based on possible combinations from ingredients available to the user. Japanese patent specifications JP 200305064 and JP 2003141337 are exemplary of such systems. It is then up to the customer to prepare a meal based on the menu prepared by the computer.

Described in WO 03/056493 is a nutrition dispenser for dispensing doses of nutrition and medicine which are customized to the needs of the customer. The customer inputs a request and the dose to be dispensed is formulated from the nutrients and medicines stored in the dispenser using rules based logic to compare the customer's health and nutritional needs with standard nutritional and medicine tables. The choices of the customer are limited by the rules governing the dispensing of ingredients by the dispenser.

It is an object of this invention to go some way to overcoming these disadvantages or at least to offer the public a useful choice.

SUMMARY OF THE INVENTION

The invention broadly consists in a system for dispensing a customized nutritional serving which comprises:

- an ingredient storage module;
- an ingredient processing module;
- a serving dispenser;
- a customer interface; and

a controller operatively linked to the customer interface and programmed to control the operation of the storage module, the processing module and the dispenser;

the controller having stored in its memory an inventory of ingredients in the storage module, their compositions and their properties, and customer profile data;

2

the controller being programmed to operate in the following manner:

when a customer selects a customized serving through the customer interface, the controller:

- a) looks up the information stored in its memory, formulates a serving which best matches the customized serving selected by the customer within predetermined constraints set by its programming and presents a selected serving to the customer for confirmation or modification;

- b) if the customer modifies the selection, repeats step a) on the modified selection, and presents the resulting selected serving to the customer for confirmation or modification; and

- c) when the customer has confirmed a serving issues instructions to the ingredient storage and processing modules and the serving dispenser to prepare and dispense the serving.

In one embodiment the ingredient processing module and the serving dispenser are integral with one another.

In one embodiment the serving dispenser is at least partly operated by a customer or by an operator.

- In one embodiment the predetermined constraints in the programming of the controller include but are not limited to one or more of the following:

- limitations or physical properties of ingredients, compatibility of ingredients with one another, limitations on certain ingredients by health status, requirements of certain ingredients by health status, availability of ingredients in the inventory, and cost.

In one embodiment the controller is programmed so that as soon as a repeat customer has been identified through the customer interface, the customer is presented with a selected serving based on a previous selection of that customer, if the customer confirms the selection the controller skips directly to step c), if the customer selects a different serving the controller begins at step a).

- In one embodiment in carrying out steps a) and b) the controller:

- uses the customer profile data to generate nutritional requirements and targets for the customer and consults the inventory of ingredients to generate limits on the inclusion levels of each ingredient, and

- selects ingredients to formulate a serving optimised to meet nutritional requirements within the constraints of available ingredients.

In another embodiment the controller selects ingredients to formulate a serving optimised to meet nutritional requirements within the constraints of other requirements.

In a further embodiment the other requirements include requirements that certain ingredients are not included together at incompatible levels and that the serving comprises sufficient but not excessive liquid ingredients in a way that departs as little as possible from nutritional targets, that matches as closely as possible the customer's preferred flavour choices, and that is as inexpensive as possible.

In an alternative, in the steps a) and b) the selected serving presented to the customer is determined through the use of a boolean-tree algorithm.

In one embodiment the ingredient storage module comprises a plurality of storage compartments.

In one embodiment some of the compartments contain powdered ingredients such as dairy powders or flour or other grain based food product.

In another embodiment some of the compartments contain stabilisers, hydrocolloids or emulsifiers.

In another embodiment some of the compartments contain condiments such as spices, herbs or salt.

In another embodiment some of the compartments contain nutrients such as vitamins, minerals or bioactives.

US 7,762,181 B2

3

In another embodiment some of the compartments contain flavourings or flavour modifiers.

In another embodiment some of the compartments contain texturing ingredients.

In another embodiment some of the compartments contain liquids such as water, juice, milk or other potable liquids.

In another embodiment some of the compartments contain gels or emulsions.

In another embodiment some of the compartments contain dried fruit or vegetables, or fruit or vegetable extracts.

In another embodiment some of the compartments are chilled or frozen.

In another embodiment some of the compartments are heated.

In another embodiment the ingredients storage module contains a dosing means for dosing predetermined amounts of ingredients stored in compartments into a serving.

In another embodiment there is provided ingredient advancing means for moving ingredients from the ingredients storage module to the ingredient processing module.

The ingredient advancing means is one or more of mechanical, gravity, vacuum, air pressure, and liquid pressure.

In one embodiment the ingredient processing module contains one or more of a mixer, a heater, a cooler or a freezer.

In one embodiment the heater is a convection heater, microwave heater, pasteuriser, irradiator, ohmic heater or high frequency sound.

In one embodiment the serving dispenser is a nozzle.

In another embodiment, the serving dispenser is an extruder. The extruder may optionally be heated.

In another embodiment there is provided a means for dispensing containers or other receptacles to be in registry with the dispensing nozzle to receive servings from the serving dispenser.

In one embodiment the controller is operatively linked to one or more servers each having stored on its memory at least some of the inventory of ingredients in the storage module and possible servings available therefrom, nutritional and health data relating to ingredients in the storage module and possible servings therefrom, and at least some of the customer profile data.

In one embodiment the controller and/or server is operatively linked to an external database.

In another embodiment the external database contains information on health and nutrition.

In another embodiment the external database contains health information of a customer.

In another embodiment the external database is a health insurance database.

In one alternative the customer profile data includes health status, records of recent purchases and preferences.

In one alternative the customer interface is a touch panel or keyboard integral with the dispensing system.

In another alternative the customer interface is a cell phone operable from a location remote from the dispensing system.

In another alternative the customer interface is a customer computer operatively linked through to the internet to the system.

In a further alternative the customer interface is a card reader which reads information digitally or magnetically stored on a card presented by a customer.

In one alternative the controller is operatively linked to a billing function.

In one alternative the billing function is operatively linked to an electronic crediting/debiting system.

4

In another embodiment the billing function is actuable by the insertion of coins, banknotes, prepaid electronic cards or the like.

In another embodiment the invention is a network of systems as defined above operatively linked to one or more servers.

In another embodiment the invention consists in an apparatus for dispensing customized nutritional servings, which apparatus comprises the combination of components of the system and/or network herein above described.

"Serving" as used in this specification includes not only a ready to consume serving of a beverage or a food, but also concentrates, sauces, toppings, condiments, or premixes which a consumer can take away to add to or use to prepare other servings.

This invention may also be said broadly to consist in the parts, elements and features referred to or indicated in the specification of the application, individually or collectively, and any or all combinations of any two or more said parts, elements or features, and where specific integers are mentioned herein which have known equivalents in the art to which this invention relates, such known equivalents are deemed to be incorporated herein as if individually set forth.

The invention also envisages constructions of which the following gives examples only.

BRIEF DESCRIPTION OF THE DRAWINGS

The invention may be more fully understood by having reference to the accompanying drawings, wherein:

FIG. 1 is a block diagram showing the components of an embodiment of the invention.

FIG. 2 is a block diagram of an ingredient storage module and an ingredient processing module of one embodiment of the invention.

FIG. 3 is a block diagram of an embodiment of a serving dispenser for dispensing a beverage serving.

FIG. 4 is a block diagram illustrating the operation of one embodiment of a system according to the invention.

FIG. 5 is a block diagram of a health profile algorithm.

FIG. 6 is a block diagram of a process loop for determining body mass index.

FIG. 7 is a block diagram of a loop for processing information of relevance to diabetes.

FIG. 8 is a block diagram of a loop for processing information concerning iron in the diet.

FIG. 9 is a block diagram of a loop for processing information of relevance to heart health.

FIG. 10 is a block diagram of a loop for processing information concerning folate.

FIG. 11 is a block diagram of a loop for processing customer requests for personal preferences.

FIG. 12 is a block diagram for processing servings according to customer preferences.

FIG. 13 is a block diagram of an interrogation for processing information to provide a customer with a drink accommodating both health profile and preferences.

FIG. 14 is a block diagram of an interrogation for ensuring that the ingredients selected and chosen are incorporated into the beverage to be served.

FIG. 15 is a block diagram of an interrogation for determining the drink to be served based on consumer history.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

The system according to the invention has both hardware components and software components. In the embodiment of FIG. 1 dispenser 10 is separate with from the server 30.

US 7,762,181 B2

5

Dispenser **10** and server **30** are in electronic communication with each other. Although a server **30** may be integral with a dispenser **10**, a single server **30** is usually linked with a network of dispensers **10**.

The ingredients module **12** of the system will normally include a number of compartments containing bulk ingredients such as dairy powders or flour and other compartments containing ingredients designed to be dispensed in minute quantities such as condiments, nutrients, flavour modifiers and texturing ingredients. Typical dairy powders include whole milk powder, skim milk powder, milk protein concentrate and whey protein concentrate. The flour ingredients include grain and other vegetable flour. The flavour modifying ingredients include condiments such as spices, herbs or salt or other flavour modifying ingredient known to those skilled in the art. Artificial flavours or nature—identical flavours may also be included.

Some compartments may contain pre-prepared ingredient mixes to permit faster preparation times.

In an alternative embodiment the ingredient compartments may contain fresh, frozen or processed fruit, such as fruit pulp, for dispensing into beverages or other servings. In a system with such an embodiment the ingredients module may be equipped with the appropriate refrigeration.

The nutrients or other health promoting components to be included in storage compartments within the ingredients module are essential fats and fatty acids, vitamins, minerals and bioactives. Bioactives including freeze dried probiotics, bioactive hydrolysate powders and the like are also stored in the compartments.

Other components to be stored include but are not limited to: agar, alginates, arabic, carrageenan, carboxy methyl Cellulose (CMC), gelatine, konjac flour, locust bean gum (LBG), methyl cellulose and hydroxypropyl methyl cellulose (MC/HPMC), microcrystalline cellulose (MCC), pectin, xanthan, acacia gum, bacterial gums, tamarind, ghatti, karaya, galactomannan, gellan polysaccharides, inulin, amylase, amylopectin, exopolysaccharides, maltodextrin, gelatine, fibre, protein, transglutaminase or hydrolysate products, amino acids, antioxidants, sugars, ginseng, guarana or caffeine.

Some of the other components also have nutritional and other benefits. For example, inulin has benefits for diabetes and konjac flour reduces dysphagia among the elderly.

Bacterial cultures, particularly lactic acid bacterial cultures, may be included in a storage compartment for use in fermented drinks or yoghurt.

Compartments of the ingredients module **12** also contain processing liquids such as water, milk or other potable liquid.

Storage compartments also contain gels such as yoghurt or emulsions such as ice creams or the like.

Chilling or refrigerating means are provided for some storage compartments where the ingredients require such conditions.

Similarly where ingredients need to be kept at temperatures above ambient, heating means can be included.

The ingredient processing module **14** includes dosing mechanisms associated with the storage compartments. These are joined by conduits into the ingredient processing module. Means to advance ingredients along the conduits typically include gravity, fluid advancing means such as augers, air or liquid pressure, or vacuum pressure at the ingredient processing end of the conduits.

The ingredient processing module **14** includes mixing means in containers disposed to receive ingredients from the ingredients storage module **12**. The mixing means include

6

mixers commonly employed in the food industry for mixing dough ingredients or other mixers known in the art.

A forming mechanism is optionally provided for some functions of the system. The mixed ingredients are then passed to a forming mechanism for forming the combined ingredients into a predetermined shape such as a nutritional bar. This is forwarded to a heating means such as a convection oven/microwave oven, high pressure, ohmic heating or ultra high frequency sound.

In one embodiment if the food selected is a pizza, the forming mechanism is a roller. The pizza base is rolled out with the roller and at an intermediate station the pizza topping is sprinkled on the base from dosing mechanisms before it is cooked in a convention oven. Other flattening mechanisms may also be used.

Where the product to be dispensed is, for example, a fluid emulsion such as a yoghurt, it is dispensed out of a nozzle into a container. In one embodiment the dispensing module **16** has a nozzle which is accessible by the customer. The customer positions a container below the nozzle and allows the fluid serving to collect in the container.

In another embodiment the container and nozzle may not be accessible to the customer. The container may be filled and then sealed with an automatic sealing device before the sealed container is dispensed to the customer.

In another embodiment of the system the ingredient processing module and the serving dispenser are combined. This would be done, for example, where there are a limited number of powdered ingredients which are readily soluble in a liquid stream. The processing and dispensing functions would be dissolving the powder in the liquid and allowing the customer to take the beverage away.

Although the operation of the dispenser is fully automated in some embodiments, in others the processing or dispensing operations may include actions of a customer or an operator. The customer or operator may have to place a receptacle, such as a cup or pottle, under a dispenser and push a start button to dispense the serving. The customer or operator may have to assist in processing or dispensing ingredients by pushing buttons or levers as directed on a screen at the customer interface.

The dispenser may have associated with it a labelling unit. This unit will be able to print and attach a label which lists the ingredients and can give any special instructions required. The label can also include the nutritional properties provided by the serving.

The controller **18** is, in one embodiment, a microprocessor having a large number of functions. It will operate interactively with the storage module **12**, with the ingredient processing module **14** and with the dispensing module **16** to ensure that the ingredients selected, dispensed and processed meet both the customer selection criteria and the health, nutritional and customer profile data requirements. It also will maintain a watch on the level of inventory and send signals to inventory operators when ingredient compartments need to be refilled.

The controller **18** will also interact with a billing module **32** in server **30**. In some instances the dispenser will be coin, bank note or debit card operated in the manner of other vending machines. In other instances the billing will be done through conventional electronic direct debiting/crediting of the point of sale transaction.

The controller **18** will be able to access customer profile data **34**. This may include previous customer menu selections and nutritional requirements of customers. Where the customer has a high level of fitness and has nutritional requirements for particular activities this will be accounted for in

US 7,762,181 B2

7

selecting the ingredients. Where a customer has allergies to certain foods (for example peanuts, gluten or phenylalanine) or has a condition, such as diabetes or high blood pressure, it will preclude the dispensing of ingredients which might aggravate the conditions.

The customer profile data **34** can, in its simplest form, contain basic information such as weight, height, age and current health status entered by the customer. Where the customer has had a more detailed health assessment or tests for certain conditions this information may be entered as well. For high performance sportspeople real time fitness information may be fed into the customer database and suitable nutritional beverages or other servings ordered for consumption at the end of or even during a workout.

When the customer has had a genotype analysis the resulting data may also be entered in the database. Nutrigenomics analyses enable the selection of servings best suited to the customer where a genotype analysis is available. Where a customer's purchases are paid for or subsidised by health insurance, making a claim at the time of purchase may be done through a linkage to the health insurance database.

The customer input will be through some form of customer interface **20**. Where the system is already storing customer profile data, the customer will only need to enter a personal identification number (PIN). Other customer identification mechanisms such as iris scanning or electronic fingerprint recognition or recognition of other biometric data may be used as alternatives to PIN entry. Another alternative is the use of radio frequency identification (RFID) or transponder systems. The interface will include a screen or speaker so as to enable interaction between the controller and the customer.

The interface could be a cell phone, a computer with internet access, or it could be a keyboard or other input device on the machine itself activated by inserting a card which can be read electronically by the device. In one alternative the customer interface may be voice activated.

A customer may register on the system through the customer interface **20**. Registration would normally include input of customer profile data. Where the customer has health information stored on an electronic card the transfer can be by the reading of that card. Alternatively, customers could key in information in response to standardised questions about preferences, health status and allergies. In another alternative health data of a customer stored on a remote computer may be accessed when authorised by the customer.

The memory would also have loaded on to it nutritional and health data **38** which can be compared with the customer's health profile to ensure that adverse ingredients are excluded. Alternatively, the controller can be programmed to access and interrogate databases such as the one at URL www.mypyramid.gov which provide health and nutritional recommendations.

The billing module **32** can be as simple as a connection to electronic crediting and debiting services offered by banks. Alternatively it can be a module taken from a conventional vending machine where coins, banknotes or electronic debit cards activate the device.

The dispenser **10** is also provided with a fortificant module **22**, and a dosing unit **24** upstream of ingredient processing module **14**. There is an electronic connection **26** between each dispenser **10** and server **30**.

Server **30** has the following functions and memory databanks. The billing function **32** is described above. The customer database **34** contains customer profiles. In addition to individual profiles it can also generate customer group profiles to be referred to when processing orders from customers not previously registered. Server **30** will also have stored on it

8

nutritional and health data **38** and formulation algorithms **36** for selecting ingredients to meet not only customer choice, but nutritional and health requirements.

A system in its simplest configuration would be a stand alone vending machine with all of the memory and programming functions within the controller.

Other embodiments consist of combinations of vending machines and a single server or multiple servers. Where there is a cluster of vending machines which is accessed by a regular set of customers, the customer profile data may be stored in the memories of each of the cluster of machines, or a local server to speed access and response times.

In operation a customer will enter their PIN or other identifier and select a serving. In a typical embodiment the customer will be presented with a menu starting with meal and snack types from which menu choices may be made.

The formulation of the menu types can either be through a general selection offered to all customers or, where the customer profile data restricts the food type, from a more restricted menu.

The customer makes his/her selection and the controller **18** will then actuate the switches governing the dispensing of ingredients leading to the mixing of the ingredients and cooking of the ingredients, where required, and then dispensing them from the machine. The size of the portions will be determined by reference to the customer profile data **34**.

In one embodiment the customer is present at the dispenser **10** and waits to collect the serving when it has been dispensed. In more sophisticated models where the customer has ordered a serving from a site remote from the machine (by cell phone or via the internet) the customer will enter input data to allow release of the serving from a dispensing station in the machine itself. Such a facility would be important where there is a time delay between the time when the meal or snack has been ordered and it is dispensed by the machine.

The system and apparatus according to the invention will also optionally contain a hygiene management system. Such a system would monitor accidental spillages and the like. When a spillage was detected the machine in question would be disabled until the spillage had been cleaned by an operator.

Where an ingredient has a limited shelf life, this information is part of the ingredient control database data. When the ingredient is placed into a compartment of the ingredients module the date is noted and the ingredient dosing mechanism disabled once the "use by" date has passed until fresh ingredient is added.

Although not intended to be limiting, typically machines incorporating the system of the invention will provide servings of a particular type. Some machines will dispense drinks such as "smoothies" or drinking yoghurts. Other machines will dispense nutritional bars mixed and formed according to the customer choice. Other machines will serve soft food such as mousses, yoghurts or ice creams. Still other machines will provide topping products such as cheese melts and pizzas.

In another embodiment the serving dispensed may be a concentrate, powder, sauce, topping or the like which is taken away and used to prepare a beverage or mix with or sprinkle on other foods such as salads, meat, vegetables, fish or the like.

Access to machines may be by membership or casually. Customers who are members will be able to have their servings customized according to their preferences and limitations in their profile data.

Machines incorporating systems according to the invention can be installed in schools. Such machines may not have individual customer data but will have profiles of typical school age children. They will be programmed to produce

US 7,762,181 B2

9

smaller servings with nutritional compensation for potentially deficient diets and other meals. For example, adolescent girls would receive extra calcium in their servings. The ingredients stored in such machines would be limited to the range to meet the nutritional requirements of the schools.

In another embodiment a machine incorporating a system according to the invention would be programmed to deliver servings suited for consumption by elderly persons. Such machines would hold the customer profile data for each of the residents of a rest home. Meals would then provide for the nutrition and health requirements of each of the individual residents. The meal requests could be made by the residents themselves or by staff on their behalf. The installation of such machines could reduce the requirement for providing kitchens and kitchen staff in rest homes. The ingredients stored in such machines would also be limited to meet the needs of the elderly persons.

The programming of machines may include information about typical tastes of target groups as well as preferred textures of food.

Another potential use of vending machines incorporating a system according to the invention is in public transport. Buses, trains or airplanes; or airports or stations could be provided with such machines to dispense either customized or casual servings to travellers.

Vending machines incorporating the system of the invention can be located in retail chain stores, in shopping malls, supermarkets, convenience stores, universities, gymnasiums, workplaces, stadiums, theatres or any other place where potential customers are likely to be seeking food or beverages.

In one use a vending machine according to the invention is installed adjacent to the sales counter of a convenience food outlet. The customer takes a purchased food item, such as a salad, to the vending machine and orders a serving, such as a dressing, which may either be dispensed directly onto the salad, or in a packet which the customer opens before spreading the dressing onto the salad.

The system according to the invention offers several advantages. In one embodiment the customer is offered the convenience of a serving which is not only customized according to preference, but also optimised for health and nutrition considerations too. Where the serving is prepared from fresh ingredients, these may be stored in conditions where they are presented in a serving in a fresher state than if they had been stored in less optimum conditions by the customer. The algorithm controlling the storage and dispensing of ingredients can be programmed to ensure that freshness is a consideration which is included.

Vending Machine With Nutritional Beverage

A schematic layout of one embodiment of the dispenser illustrated in FIG. 1 for dispensing nutritional beverages is illustrated in FIGS. 2 and 3.

Within an environment control unit 40 which, where required, can be hermetically sealed, there is an ingredient storage container 44 having a radio frequency identification (RFID) ingredient recognition chip 42 provided for identifying which ingredients are stored in the machine. An ingredient agitation/stirring unit 46 is provided to assist in advancing the powdered ingredients from container 44.

Also illustrated is a stock level sensor 48 to provide inventory information.

Below the storage container 44 there is provided a drive mechanism 50 which drives the feeding mechanism 52, such as an auger, which advances the ingredient from the storage

10

container 44 into a tube 56. There is a measurer 54 on tube 56 to measure the amount of ingredient dispensed.

A chute 58 is aligned with tube 56 to receive powdered ingredients discharged from container 44. Chute 58 provided with an agitator 60 to keep powders from sticking.

Each separate ingredient has a separate storage container with the associated components just described.

Referring to FIG. 3, a powder manifold 65 is provided in communication with a source of fortificants 64 and with the sources of ingredients 62. The fortificants 64 may be provided in a powdered form from a precise powder measuring device, or alternatively may be provided in a pre-manufactured tablet with a precise dosage. The ingredients 62 will have been discharged from a chute 58 associated with each ingredient container 44.

A liquid ingredient manifold 66 is also provided. Manifold 66 is in communication with liquid sources 68. Below the manifolds 65 and 66 is a cup dispensing mechanism 76 of the type commonly found with beverage dispensing machines. A cup 78 is illustrated. The paths of ingredients and liquids to be dispensed into cup 78 are illustrated by arrows 80 and 82.

The dispensing and processing functions are completed by the provision of a mixer drive 70 and mixer head 71 in the form of an impeller. The impeller cleaner 74 provided with an appropriate water spray nozzle is included. The impeller motor 70 and head 71 may be moved in the direction of arrow 72 A to mix the ingredients in a cup 78 or in the direction of arrow 72 B to allow for cleaning of the head or impeller 71.

In operation after the consumer has agreed to the selected nutritional beverage and the formulation algorithms have determined the quantities of ingredients required, the drive 50 actuates the feeding mechanism 52 to feed powdered ingredients through tube 56. Where required the stirring mechanism 46 ensures that the powdered ingredient is not stuck within the ingredient storage container. The amount of ingredient dispensed can be determined by a time operation of the motor 50 and/or by the measuring the amount of ingredient through measurer 54. If powdered ingredient gets stuck in chute 58 agitator 60 is able to release it.

The nature of the ingredient within storage container 44 is identified by the RFID chip 42. The level of ingredient remaining is signalled to the controller by the stock level sensor 48.

Where the ingredient requires a controlled atmosphere, such as a reduced level of moisture or oxygen, then the atmosphere within the environmental control unit 40 can be adjusted appropriately.

Ingredients 62 from ingredient storage modules 44, as illustrated in FIG. 2, together with fortificants 64 are collected in manifold 65. Liquid ingredients such as water, carbonated water or liquid flavourings are all collected in manifold 66. These are then released, usually by gravity, down pathways 80 and 82 into a cup 78. The mixer drive 70 and mixer head 71 are manoeuvred in the direction of arrow 72 A to a position where head 71 is in cup 78 and agitates the contents for a predetermined time to achieve an homogeneous mixture.

Where the ingredients have a high protein content, such as milk protein concentrate or isolate, the head 71 is operated at a reduced speed so as to avoid excess frothing.

When the predetermined mixing time is complete the drive motor 70 is raised out of the cup 76 and pivoted to position the head within the cleaning unit 74 to clean the unit.

The cup 78 is then available for the customer to remove the beverage.

US 7,762,181 B2

11

Operation of Nutrition Beverage Dispenser

The operation sequence from the initial contact of the user through to the end of a cycle for a nutritional beverage dispensing machine of the type illustrated in FIGS. 2 and 3, is illustrated in FIG. 4 by reference to table 1 below. The numbers in the circles in FIG. 4 are not reference numbers but numbers of the step in the left column of Table 1.

Step 1 is required for a user who has not previously used the system and is not a registered member. That user may enter health information at the machine, via the internet, by mobile phone or at a membership station, which may be a user interface not integral with the dispensing machine.

At step 2 the system provides an identifier. This may be a personal identification number (PIN), information loaded onto a smartcard or information loaded onto an RFID chip in a cup to be dispensed with the beverage.

In step 3 the user's health information data is stored in the memory of the controller on the machine, on the network server or on an ID carrier, smartcard or RFID to be retained by the user.

At step 4 the user logs into the device using the interface panel on the machine, by text message, by email or through a website.

Where a user is already a member of the system they will begin at step 25 in FIG. 4. The first step is for the user to enter their ID. Then at step 5 this is verified on the interface panel, on the remote computer or on the mobile phone as the case may be.

At step 5 these user's ID is verified and their profile and preference information presented on the interface panel of the vending machine, on a remote computer or on the mobile phone as the case might be.

At step 6 the user adds any update of their health status and immediate preference details. This can be done through the user interface on the machine, by text mail or via the website as the case may be.

At step 7 the program in the computer or the server then runs the algorithm with the stored information and the updated choices through a logic system or an optimisation program.

At step 8 the beverage recommendation is presented to the user. This may be done on the interface panel of the machine, by text message, by email or on the website as the case might be.

12

At step 9 the user makes changes based on personal preferences and available ingredients.

At step 10 the user confirms the modified selection.

At step 11 the controller issues instructions for the ingredient storage and processing modules and the server dispenser to prepare and dispense the serving.

At step 12 the system checks for payment via a smartcard reader, by a coin drop, by direct debit or by other means associated with the machine or database.

At step 13 payment is made.

At step 14 the controller checks the sequence and delivery amounts information.

At step 15 it sends the signal to the motors and pump to deliver in the time pattern specified by the algorithm.

At step 16 the ingredients are delivered by liquid pumps, powder dispensers, tablet doses and the water supply.

In step 17 the user may be notified of the stage of preparation of the beverage as it progresses. This may be done in screen notes or by illuminating parts of the machine on the front panel.

At step 18, when the beverage is in the cup, the mixer is activated.

At step 19 when the mixer has been removed from the cup the drink ready signal is issued and the consumer then removes the drink.

In optional step 20 information about the drink formulation may be displayed. This may be displayed on the screen at the user interface or in a printed receipt. It may be printed on a label to be affixed to the cup or it may be printed on packaging when the beverage is served in a package rather than a cup. If the serving is delivered in a package.

At step 21, information on the ingredient delivery is updated in the database for the purpose of keeping track of ingredient inventory and also to keep a record of the amounts of ingredients which the user has consumed.

At step 22 the cleaning sequence is activated so that cleaning head 71 in FIG. 3 is cleaned in head cleaner 74.

At step 23 the stock level information is transmitted to the inventory database so that restocking schedules can be prepared to ensure that the machine does not run out.

At step 24 the machine is reset to reboot the user screen and to put the ingredient dispensing module into the rest position.

The final step 26 is for the initial user prompt to join membership to appear on the interface panel.

TABLE 1

Operation Sequence for Nutrition Beverage Delivery (to be used with FIG. 4)

| Action | Options | | | |
|--|--|----------------------------|--------------------------------|-----------------------|
| | a | b | c | d |
| 1 User Joins membership enters health information | At machine | on internet | by mobile phone | at membership station |
| 2 Machine provides ID | pin number | loads smart card | loads RFID chip in cup | |
| 3 User health data stored | On machine | on network server | on id carrier, smart card/RFID | |
| 4 User logs into POSI machine | on interface panel or machine hardware | by text message | by email | on website |
| 25 Fast track usage | At machine | | | |
| 5 User ID verified and profile and preference information presented | on interface panel | on remote computer | on mobile phone | |
| 6 User adds current health status and momentary preference details | on interface panel | by text message | by email | on website |
| 7 Program runs algorithm with stored information and updated choices | Logic system | Optimisation Logic Program | | |
| 8 Drink recommendation submitted to user | on interface panel | by text message | by email | on website |
| 9 User makes changes based on preference and ingredients | on interface panel | by text message | by email | on website |

US 7,762,181 B2

13

14

TABLE 1-continued

| Action | Options | | | |
|--|----------------------------|-----------------------------|--------------------------------------|----------------------------------|
| | a | b | c | d |
| 10 User confirms selection | on interface panel | by text message | by email | on website |
| 11 Algorithms calculates drink formulation | Logic system | Optimisation Program | | |
| 12 System checks for payment | Smart card reader | coin drop | network check of database | network direct debit check coins |
| 13 Payment made | Smart card | account reference | direct debit | |
| 14 Controller checks sequence and delivery amounts information | | | | |
| 15 Motors and pump signals delivered to time pattern | | | | |
| 16 Ingredients delivered | liquid pumps | powder dispensers | tablet doser | water supply |
| 17 Information conveyed to user drink dispensing stages | On screen notes | in machine illumination | | |
| 18 mixer activated | | | | |
| 19 Drink ready signal | | | | |
| 20 Information about drink formulation displayed | On screen notes | printed receipt | label printed and added to packaging | printed on packaging |
| 21 information on ingredient delivery updated in database | ingredient storage amounts | User consumption | | |
| 22 Cleaning sequence activated | | | | |
| 23 Stock level information transmitted | telephone/text message | networked computer database | | |
| 24 machine reset | screen reboot | dosers rest | | |
| 26 User prompted to join membership | on interface panel | | | |

Pasta and Pasta Sauce Vending Device

Existing devices for preparing servings of food for dispensing from automatic vending machines can be adapted for use with the system of this invention.

One such device is described in US published patent application US 2002-0152896. The device described in that application stores pasta and the ingredients for making a pasta sauce. When a customer places an order the pasta is released into a pasta cooking pot and boiling water is added to cook the pasta. The pasta is then dispensed onto a plate. The customer selects the sauce. The ingredients, from separate storage compartments, are mixed and combined with water either prior to or after mixing with the pasta so that the customer receives a fully cooked pasta with sauce from the machine. The storage compartments for the pasta would form another component of the storage module illustrated in FIG. 1. The water dispensing and cooking functions would form a part of the processing module.

Among the ingredients to be dispensed into the sauce would be appropriate nutrients customized to the customers' health status requirements and preferences.

Boolean-Tree Algorithm for Preparation of Beverage for User

1. Introduction

A number of simple logic-trees employing information obtained from the consumer combined with nutritional and functional knowledge are used to determine the most appropriate outcome.

To demonstrate the progression through the Boolean-tree, a fictitious customer, Mike, will be followed from data entry through to the determination of the final drink demonstrating how the steps of Table 1 and FIG. 4 are done. Mike is a 46 year-old male, 6'1" tall and weighing 93 kg. He suffers from type II diabetes, and has high blood pressure and high cholesterol.

2. Initial Choices

When the consumer approaches the vending machine, there may be a number of different options for determining their beverage choice. They may want the "fast-track" option. This allows them to choose a drink base, flavour, and add desired "shots" such as "immune" or "femme". This is quick and simple, but does not make use of the major benefit of the system of the invention—the ability of the system to make specific recommendations based on the individual health profile.

The customer may have already entered their health data into the system, either during an earlier purchase at a vending machine, or possibly online at a website. If this is the case, they can simply enter their user ID and PIN, swipe their smart card, or use whatever technique is chosen to identify registered members, and the computer system in the vending machine will access the network and find the data relating to that customer.

If the customer has not yet entered their health data, they may do so at this stage. For the purpose of this example, Mike selects this option.

3. Health Profile

When the customer decides to enter their health data, they will go through an algorithm that will collect information that will be stored as their "health profile". This health profile will consist of a variety of both permanent and variable data regarding the health and general preferences of the individual. The permanent data is collected and stored as fixed information, while the variable data may be automatically set to a default but is able to be changed each time the vending machine is used.

A typical flow-chart outlining the type of information and options that may be used to collect information for the health profile is shown in FIG. 5 with the individual loops shown in FIGS. 6 to 11. These are representative questions that may be used. When the machine is intended to be used with classes of

US 7,762,181 B2

15

users, for example school children or the elderly, the questions would be tailored to the user group.

The first questions are relatively self-explanatory, and seek information on the customer's sex and age. The age brackets are based on similar nutritional needs and may be broken into smaller ranges to ensure the consumer feels comfortable about the question. Mike is male, and between 46-70 years of age.

BMI Loop

Referring to FIG. 6, an individual's body mass index (BMI) is measure of body fat based on height and weight, and is an important indicator of risk for a variety of health concerns. The BMI is calculated by dividing the person's weight in kilograms by the square of their height in meters. The BMI loop calculates the BMI based on information provided by the consumer, allowing for the figures to be entered either in metric or imperial units. Generally, a BMI greater than 25 is an indication that a person is overweight. However, people tend to over-estimate their height and under-estimate their weight, and so a BMI greater than 24 has been used as a cut-off. The height and weight of a consumer could also be measured at the machine through the use of currently-available technology and BMI calculated by the measuring device.

Mike's BMI is calculated from his height (6'1") and weight (93 kg) as follows:

$$\text{Height in meters} = ((6 \times 12) + 1) \times 2.54 / 100 = 73 \times 2.54 / 100$$

$$1.85 \text{ m}$$

$$\text{BMI} = 93 / (1.85 \times 1.95)$$

$$27.2$$

Therefore Mike fits into the 'BMI>24' category.

Diabetes Loop

If a person has either type I or type II Diabetes, either the body does not produce enough insulin or the cells ignore the insulin. Insulin is necessary for the body to be able to use sugar. When glucose builds up in the blood instead of going into cells, it can cause a variety of problems. Therefore, it is important for people with diabetes to control their sugar intake. Different sugars have different effects on blood glucose levels, with sucrose and glucose having the largest effect. Effectively calorie-free sweeteners like aspartame, saccharin, sucralose and acesulfame-K will not increase the blood glucose level, but the sugar alcohols (xylitol, mannitol, and sorbitol) have some calories and will increase blood glucose slightly. It is also important to consider overall carbohydrate intake, as calorie for calorie, all digestible carbohydrates raise blood glucose about the same amount (American Diabetes Association, 2005). There is also evidence that eating a healthy diet with a low level of sugars may help delay the onset of the disease in those with risk-factors for developing type II diabetes.

The diabetes loop shown in FIG. 7 shows an example of possible questions and outcomes that take into account whether an individual has diabetes or some of the potential risk factors.

Mike does have type II diabetes, so he would be assigned a high priority for no-sugar. This requires that drinks must not contain any sucrose or glucose, and must not have a total sugars content of more than 5%. If he had not yet been diagnosed with diabetes, the logic-tree would have registered that he was over 45 years of age and had a BMI greater than 24 and would have suggested that he consider choosing to make no sugar a high priority. The customer may over-ride the

16

nutritional recommendations with this example, but warnings will be displayed to ensure they are aware that their decision is against nutritional advice.

The other two priority levels are medium and low. A medium priority means that a constraint will be placed upon the drinks recommended by the system to ensure that the total sugars present will not exceed 10%. A low priority for no sugar means that the amount of sugar will not influence any decisions made regarding which drink to recommend to the customer.

Iron or Calcium Loop

Inadequate dietary intakes of iron and calcium are commonplace among women in many western countries, and have been implicated in development of problems such as anemia and osteoporosis. However, it is not desirable to give extra dietary iron to males or to women already taking iron supplements.

The iron loop in FIG. 8 allows a customer response to a question regarding their iron intake to be accepted or queried based on other aspects of their health profile. If the customer says that they are not concerned about their iron intake, the system checks their sex and if they are female, posts a message explaining that women tend to be low in iron. It enquires whether the individual is taking a supplement that contains iron, and if they aren't, another message is presented that strongly recommends that the customer consider making iron a high priority. A high priority for iron means that the system will include extra iron in the drink unless specifically directed otherwise by the consumer; a medium priority means that iron will be added unless it conflicts with a higher priority instruction; and a low priority will not result in the addition of iron unless the customer specifically asks for it. A similar loop is used for calcium.

Mike is unlikely to be concerned about the level of iron or calcium in his diet, and as he is a male, the system will avoid the message system and simply assign both iron and calcium a low priority.

Heart Health

In the western world there are increasing numbers of people suffering from conditions such as atherosclerosis. Research has identified a variety of micronutrients which appear to improve heart health, including antioxidants (vitamin E), omega-3 fatty acids, and folic acid. A loop for heart health is shown in FIG. 9.

With his current health status, Mike should be concerned about heart health. However, if he was unsure, this loop prompts him to consider possible risk factors he may have. Even if Mike is totally unaware of the strain his heart may be under, the logic tree examines his health profile and registers that he is over 45 years of age and has a BMI greater than 24. Based on this information, a recommendation message is presented which prompts Mike to make heart health a high priority. This would ensure that the heart health ingredients will be added to all his drinks unless he specifically over-rides that instruction.

At present, this heart-health loop refers to a single "heart shot" made up of three components—omega-3, vitamin E and folate. Whatever choice an individual makes with regard to heart health priority, it is applied to the group of ingredients rather than the individual components. In an alternative, this is changed to consider the separate ingredients instead, allowing greater flexibility in meeting consumer needs. Such an alternative requires more ingredient streams and more input from the consumer.

Folate Loop

As well as being involved in heart health, folate is also very important in women's health, especially during adolescence and pregnancy. The folate loop in FIG. 10 is only shown to customers who are female.

The system of this example operates in terms of "bases" and "shots", and "heart health" corresponds to a single shot. Therefore, since the folate is included in the "heart shot" there is no point in having it set to high priority on an individual basis. In a system where the "shots" approach is not used the folate loop would need to be adjusted accordingly.

As Mike is male, the system will not show him the folate loop. He will already be getting extra folate from his decision to make heart health a high priority.

Personal Preferences Loop

The final loop in this section of the health, illustrated in FIG. 11, is about personal preferences. The logic tree is able to restrict the drink choices presented based on the customer health profile (i.e. no sugar priority), but the customer is able to have a certain amount of input into the type and flavour of drink that will be recommended by the system. In other examples where more drink types and flavours are added to the system this part of the logic tree will be substantially larger.

Mike has no sugar as a high priority, so automatically will have a milk-based drink set as his default. He prefers hot chocolate, and has a bit of a sweet-tooth so chooses a sweetness level of 3. Artificial sweeteners are used Mike can still have it extra sweet without compromising his diabetic condition.

4. Choice

Once a customer has entered their health profile, either at the vending machine or online, the system will recognise them and be able to call up their specific information from the databases. In this example a record is kept of a customer's history of choices, including their favourite drink, the times and places that vending machines are commonly accessed, and their usual daily intake of various nutrients.

FIG. 12 is a logic tree approach for someone who has entered their health data logs into a vending machine. The customer is welcomed, and if they have used the system before, they can be offered the same drink as they had last time as a quick choice. Other options include answering some 'variable data' questions on the customer's current health or status, which may change the health profile and thus the drink recommendation. The customer can then either ask for an updated version of their last drink ("today's version") or a drink based on their stored health profile/preferences information ("stored preferences").

Mike has not used the system before, so he has no history data to allow him to chose the "same as last time" or "today's version" options. He answers "no" to each of the three questions, then presses the "stored preferences" button.

The answers to the 'variable data' questions is combined with that stored in the customer's health profile, and the system works through a further logic tree to determine what the drink is that most closely matches the requirements of the customer's health status and the customer's personal preferences. An example of such a logic tree is shown in FIG. 13.

Working through the FIG. 13 logic tree for Mike, he did not select brain or immune. Heart health was a high priority, so he will get the heart shot. Neither iron nor calcium were high priority, and the energy level is to be kept low. His preferred base was milk, and he likes it hot. However, he is getting the heart shot, which means that he must have it in a cold beverage. The preferences for chocolate and extra sweetness are

not affected by this change. To see the actual ingredients that each shot corresponds to, and to ensure that a selection of two shots which overlap in ingredients does not cause a double dose of any ingredient to be added to the product, FIG. 14 is used. The final recommended drink is an extra sweet iced chocolate milk-based beverage (low calorie and low in sugar) with added vitamin E, folate and omega-3 for heart health.

Mike is presented with this recommendation, and given the option of changing the flavour, shots, temperature and base. However, should any of his changes produce a drink which goes against the recommendations based on his health profile, a message explaining this will be shown. If Mike then decides to over-ride the recommendation he does so in an informed manner.

Now that Mike a 'history' with the system, he can use the "same as last time" or "today's version" options shown on FIG. 12. Today he feels like he may be coming down with a cold, and so he answers 'yes' to the 'are you feeling under the weather' question. This stimulates the system to add the Immune shot to Mike's drink. Mike then presses the "today's version" button.

The system can access the record of the drink Mike had last time, and so a simpler logic tree is able to be used this time (FIG. 15). Working through this example for Mike, he did not select brain but he did ask for the immune shot. He did receive the heart short last time, but not the bone or femme shot. He hasn't asked for the energy level to be increased so it is to be kept low like last time. Neither iron nor calcium were high priority, and the energy level is to be kept low. His previous base was an extra-sweet chocolate milk, and since it was already cold it is not going to be affected by the addition of the immune shot. Again using FIG. 14, the final recommended drink is an extra sweet iced chocolate milk-based beverage (low calorie and low in sugars) with added vitamin E, folate, and omega-3 for heart health, and a probiotic with extra calcium and iron for an immune boost.

Just in case what Mike thought he had last time wasn't what he really did, he is presented with the summary of the beverage, and can choose to change the flavour, shots, temperature and base in a similar manner to last time.

A summary of five consumers (including Mike) with the permanent information in their health profile, their personal choices, and their responses to the variable data questions for that day is shown in Table 2. The interrogation set out in FIG. 13 has been used to determine the best drink to recommend for each individual based on this information, and this is shown in Table 3.

The individuals were all given the option to change the recommended drink, and their final choices are outlined in Table 4. The compositions calculated from the final choices are set out in table 5.

TABLE 2

| Health profiles and drink recommendations | | | | | |
|---|-------|-------|------|---------|--------|
| | Sam | Mike | Matt | Carolyn | Sarah |
| Permanent data in profile | | | | | |
| Sex | Male | Male | Male | Female | Female |
| Age | 19-45 | 46-70 | <18 | 19-45 | 19-45 |
| BMI | <24 | >24 | <24 | <24 | >24 |
| No sugar | Low | High | Low | Low | Low |
| Iron | Low | Low | Low | High | High |
| Calcium | Low | Low | Low | Medium | High |
| Heart health | Low | High | Low | Low | Low |
| Folate | Low | Low | Low | Low | High |

US 7,762,181 B2

19

TABLE 2-continued

| Health profiles and drink recommendations | | | | | |
|---|----------|-----------|-----------|----------|--------|
| | Sam | Mike | Matt | Carolyn | Sarah |
| Base preference | Juice | Milk | Milk | Juice | Milk |
| Flavour | Tropical | Chocolate | Chocolate | Tropical | Coffee |
| Temperature | Cold | Hot | Cold | Cold | Hot |
| Variable data | | | | | |
| Today's activity | Low | Low | High | Low | Low |
| Immune | Low | Low | Low | High | Low |
| Brain | Low | Low | High | Low | Low |

TABLE 3

| Recommended drinks based on FIG. 12 interrogation | | | | | |
|---|------------|-----------|---------------------|-----------|----------|
| | Sam | Mike | Matt | Carolyn | Sarah |
| Energy Base | High Juice | Low Milk | High Fruit smoothie | Low Juice | Low Milk |
| Flavour | Tropical | Chocolate | Tropical | Tropical | Coffee |
| Temperature | Cold | Cold | Cold | Cold | Hot |
| Heart | No | Yes | No | No | No |
| Brain | No | No | Yes | No | No |
| Femme | No | No | No | No | Yes |
| Immune | No | No | No | Yes | No |
| Bone | No | No | No | No | No |

TABLE 4

| Drinks as changed by the consumers | | | | | |
|------------------------------------|------------|-----------|---------------------|-----------|----------|
| | Sam | Mike | Matt | Carolyn | Sarah |
| Energy Base | High Juice | Low Milk | High Fruit smoothie | Low Juice | Low Milk |
| Flavour | Tropical | Chocolate | Tropical | Tropical | Coffee |
| Temperature | Cold | Cold | Cold | Cold | Hot |
| Heart | No | Yes | No | No | No |
| Brain | No | No | Yes | No | No |
| Femme | No | No | No | No | Yes |
| Immune | No | No | No | Yes | No |
| Bone | No | No | No | No | Yes |

TABLE 5

| Calculated compositions of beverages for each health profile | | | | | |
|--|---------|---------|---------|---------|---------|
| Composition | Sam | Mike | Matt | Carolyn | Sarah |
| Water (g) | 321.141 | 356.608 | 315.361 | 344.386 | 351.075 |
| Protein (g) | 25.1 | 20.401 | 25.338 | 20.05 | 20.246 |
| Fat (g) | 0.083 | 0.854 | 0.87 | 0.066 | 0.467 |
| Saturated fat (g) | 0.056 | 0.367 | 0.387 | 0.045 | 0.314 |
| Total carbohydrates (g) | 49.425 | 16.827 | 51.845 | 29.704 | 20.703 |
| Carbohydrate not fibre (g) | 39.008 | 11.328 | 42.283 | 21.996 | 15.703 |
| Fibre (g) | 10.418 | 5 | 9.063 | 7.709 | 5 |
| Complex carbohydrate (g) | 0.058 | 0.32 | 0.058 | 0.107 | 2.475 |
| Sugar (g) | 38.95 | 10.544 | 42.224 | 19.541 | 10.544 |
| Lactose (g) | 0.221 | 11.129 | 13.178 | 2.525 | 13.235 |
| Ash (g) | 3.385 | 4.341 | 5.616 | 4.906 | 6.628 |
| Energy (kJ) | 1251.22 | 655.347 | 1325.4 | 834.583 | 702.041 |

20

TABLE 5-continued

| Calculated compositions of beverages for each health profile | | | | | |
|--|---------|---------|---------|---------|---------|
| Composition | Sam | Mike | Matt | Carolyn | Sarah |
| Energy from fat (kJ) | 3.126 | 32.171 | 32.793 | 2.501 | 17.586 |
| Ca (mg) | 286.902 | 777.335 | 946.79 | 538.241 | 1060.65 |
| K (mg) | 1304.69 | 499.153 | 875.403 | 993.081 | 569.853 |
| P (mg) | 185.373 | 130.125 | 130.125 | 174.324 | 136.185 |
| Na (mg) | 60.7735 | 89.903 | 109.5 | 48.6188 | 88.3 |
| Cl (mg) | 5.6354 | 0.1106 | 0.1106 | 4.5305 | 0.1106 |
| Fe (mg) | 0 | 0 | 0 | 4.5214 | 4.6096 |
| Mg (mg) | 115.852 | 99.9907 | 111.839 | 107.825 | 106.339 |
| Zn (mg) | 3.7496 | 3.7496 | 3.7496 | 3.7496 | 3.7566 |
| Vitamin A (mg) | 0.1746 | 0 | 0.1309 | 0.0873 | 0 |
| Vitamin C (mg) | 295.932 | 14.9986 | 225.699 | 170.537 | 30.07 |
| Vitamin D (mg) | 0.0025 | 0.0025 | 0.0025 | 0.0025 | 0.0025 |
| Vitamin E (mg) | 0 | 5 | 0 | 0 | 5 |
| Thiamin (mg) | 0.375 | 0.375 | 0.375 | 0.375 | 0.375 |
| Riboflavin (mg) | 0.425 | 0.425 | 0.425 | 0.425 | 0.425 |
| Niacin (mg) | 4.9995 | 4.9995 | 4.9995 | 4.9995 | 4.9995 |
| Vitamin B6 (mg) | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 |
| Folate (mg) | 0 | 0.1 | 0 | 0 | 0.1 |
| Vitamin B12 (mg) | 0.0015 | 0.0015 | 0.0015 | 0.0015 | 0.0015 |
| Pantothenic acid (mg) | 2.4998 | 2.4998 | 2.4998 | 2.4998 | 2.4998 |
| Caffeine (mg) | 0 | 0 | 0 | 0 | 62.84 |
| Omega 3 (mg) | 0 | 99.96 | 99.96 | 0 | 0 |
| EPA + DHA (mg) | 0 | 79.968 | 79.968 | 0 | 0 |
| Probiotic ($\times 10^9$ cfu) | 0 | 0 | 0 | 5 | 0 |

Optimising Servings According to Nutritional Content, Preference and Cost

Outline of Problem

The user's health status is determined from information obtained from them by the method described with reference to FIGS. 5 to 11 or in any other way. Each health status is associated in a database with nutritional preferences as defined by nutritionists. Customer preferences such as flavour, solid or liquid or other are also defined by the user as described with reference to FIG. 12 or in any other way.

An optimisation routine formulates a recipe for a serving based on these preferences, made optimal by means described in the Objective Function section below.

Features of the overall recipe may also be defined as functions of the amounts of each component and property in the recipe. In one embodiment some flavour characteristics are features. In another embodiment viscosity is a feature. In another embodiment glycaemic index is a feature.

US 7,762,181 B2

21

The recipe for a serving to be dispensed is a combination of various streams in certain proportions. The streams themselves are made up of varying numbers of ingredients. Each ingredient has physical components (such as calcium content) as well as intangible properties (such as energy content, organic status, or genetically modified status).

Combining these is first formulated as an optimisation problem. Solution methods that may be applied to the problem are described.

Problem Formulation

Variables

Variables representing amounts of each stream in the recipe are defined. In one embodiment some streams are available only in discrete units (such as tablets containing a known amount of vitamin E). In this case the variables corresponding to these streams are discrete. For instance, if x_9 corresponds to a stream that is available only in 0.3 g tablets, then x_9 should be an integer variable representing the number of discrete units in the recipe. The total weight in grams of these tablets in the recipe is then $0.3x_9$.

Further variables required are defined as the amounts of each component and property that have been consumed on a particular day, prior to the current serving.

In one embodiment binary variables are defined indicating whether each stream is used in the recipe or not. Non-negative integer variables $y_i \leq 1$ are thus required for each stream, where i is a number corresponding to a particular stream.

All variables are defined, in one embodiment, with finite upper bounds. The amount of any stream in the recipe is limited by the size of the recipe. Binary inclusion variables are obviously bounded above by 1. The amounts of each component and property already consumed on a day might theoretically have no bound, but the variables representing this are defined to have upper bounds. If more than this upper bound has actually been consumed then the variable will be assigned the value of the upper bound. In the case where the amount of a component or property in a serving is bounded above, the upper bound is set to the maximum amount of that component or property permissible in a serving. Otherwise a suitably large value is chosen that bounds daily consumption from above.

Objective Function

In one embodiment penalty weightings are applied to each nutritional and flavour intensity preference so that satisfaction of the preference attracts no penalty but deviation from the preference is awarded a number of penalty points. The objective is to minimise nutritional and flavour intensity penalty points and total cost. Other factors may be identified and incorporated in the same way that nutritional and flavour preferences and total cost are combined.

Penalty points are awarded as follows. For each component or property of the ingredients, and for each feature of this recipe a target value for the level of that component or property or feature is specified. A range either side of this value is allowed with no penalty. Every unit by which a recipe falls outside this range incurs a number of penalty points given by a function of the amount of that component or property or

22

feature in the serving. In one embodiment this function is convex.

A positive weighting is assigned to penalty points incurred by deviation from the target value of each component or property or feature and to the overall cost. The objective function is to minimise the total of all weighted penalty points and the weighted cost.

In one embodiment all weightings assigned to penalty points incurred because of nutritional targets are made so large relative to other weightings that nutritional targets are prioritised absolutely over other targets such as flavour and cost. This is possible since the values of each variable and thus the deviations of each variable from any fixed target are bounded.

In one embodiment all weightings assigned to penalty points incurred because of flavour targets are made so large relative to other weightings that flavour targets are prioritised absolutely over other targets such as cost.

In another embodiment weightings assigned to penalty points incurred because of each target are made such that the one group of targets is prioritised partially over another.

In one embodiment the relative priorities are set by the user. The degree of weighting placed on nutrition, flavour and cost are standardised to sum to 100. Values of each can be changed directly by the user.

In one embodiment the relative priorities are represented by the position of a point in a triangle on the screen, with corners labelled "Nutrition", "Flavour" and "Cost". The user selects a point in the triangle. The distance from that point to each corner is calculated and the relative priorities thus determined by some monotonic function of the distances are displayed. The user can switch between direct adjustment of the weightings and movement of the point in the triangle, observing in real time how each affects the other.

According to one embodiment, nutritionists will have chosen certain relative priorities and optimised the recipe for each health status (or perhaps each health status/flavour preference combination), storing the results in a database. The resulting recipe is then immediately available as a preset selection for users matching that profile.

Constraints

For each component and property or feature a minimum and maximum can be specified. These are absolute limits desired on the total amount of certain components or properties or features in the serving. Not all components and properties and features may require explicit limits on minimum or maximum amount per serving.

There are also daily minima, maxima and objective function penalties, entirely analogous except that to the amount of each component or property or feature in the current recipe is added the variable representing the current daily amount of that component or property or feature.

Further constraints for each component and property and feature are required in order to assign the penalties used in the objective function.

US 7,762,181 B2

23

Penalties are applied as follows. Suppose the amount of a component or property or feature in a recipe is c and the target value is t . Define positive variables $p+$ and $p-$. Then the constraint $c=t+p+-p-$ implies that if there is a penalisable excess of any component or property or feature then its value is $p+$ and if there is a penalisable shortage of any component or property or feature then its value is $p-$. These definitions must be made for every criterion in the objective function, that is, two for each component and property and feature (one per recipe and one per day). Any piecewise linear constraint or objective function can be modelled within integer programming.

Further components and properties and features can be added as new ingredients become available or new properties or features are investigated.

Several potential incompatibilities exist between streams; for instance, coffee flavour and juice ought not to be combined in the same drink. Constraints are added to ensure that incompatible streams are not included in servings together.

24

These constraints can be expressed linearly, since the quantity of each stream is bounded. The compatibilities of streams are given in Table 6.

In general if a linear constraint or set of constraints applies only under some condition that itself can be expressed as the violation of a second linear inequality or set of inequalities, this logical relationship can be expressed in the form of a mixed integer linear program.

A constraint ensures that the total mass of all streams sums to the desired amount. In one embodiment the desired amount is 400 g.

In one embodiment, a constraint is added to ensure that liquids form a sufficient proportion of the total drink.

In one embodiment, constraints limit total amounts of some streams in the serving.

In one embodiment, constraints ensure the inclusion of key streams. In one embodiment WPI is a key stream. In one embodiment MPC is a key stream.

The controller obtains limits on the availability of each stream in the machine and constrains the recipe to include no more of each stream than is available.

TABLE 6

| | Compatibility | | | | | | | | | | | | | | |
|--------------------|---------------|-----|-------|-------|------------|--------------------|-----------|-----------|-------|----------------|-------------------|----------------|-------------------|-----------|------------|
| | WPI | MPC | Juice | Omega | Folic acid | Sucralose solution | Probiotic | Vitamin E | Ca/Fe | Coffee Flavour | Chocolate flavour | Exotic flavour | Vitamins/minerals | Hot water | Cold water |
| WPI | ✓ | | | | | | | | | | | | | | |
| MPC | ✓ | ✓ | | | | | | | | | | | | | |
| Juice | ✓ | ✓ | ✓ | | | | | | | | | | | | |
| Omega | ✓ | ✓ | ✓ | ✓ | | | | | | | | | | | |
| Folic acid | ✓ | ✓ | ✓ | ✓ | ✓ | | | | | | | | | | |
| Sucralose solution | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | | | | | | | | | |
| Probiotic | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | | | | | | | | |
| Vitamin E | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | | | | | | | |
| Ca/Fe | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | | | | | | |
| Coffee Flavour | ✓ | ✓ | X | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | | | | | |
| Chocolate flavour | ✓ | ✓ | X | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | | | | |
| Exotic flavour | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | | | |
| Vitamins/minerals | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | | |
| cold water | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | |
| hot water | ✓ | ✓ | X | X | ✓ | ✓ | X | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |

US 7,762,181 B2

25

Optimization Algorithm for Preparation of Beverage
for User

Users' personal health profile may be obtained in a similar way to that described in Section 3 of the Boolean-Tree algorithm. Health profiles and drink preferences for five consumers are summarised in Table 2.

Based on this information, the recommended targets, minima and maxima per serve for various characteristics may be calculated for the five consumers. As an example, the nutritional requirements for Mike are shown in Table 7.

TABLE 7

| Nutritional Targets and Weightings | | | |
|------------------------------------|--------|---------|---------|
| Characteristic | Target | Minimum | Maximum |
| Ca (mg) | 500 | 0 | 7000 |
| Vit C (mg) | 15 | 0 | 200 |
| Fe (mg) | 0 | 0 | 50 |
| Zinc (mg) | 3.8 | 0 | 50 |
| Mg (mg) | 100 | 0 | 2000 |
| Vit D (mg) | 0.0025 | 0 | 0.025 |
| Vit E (mg) | 5 | 0 | 20 |
| Thiamin (mg) | 0.38 | 0 | 2 |
| Riboflavin (mg) | 0.43 | 0 | 2 |
| Niacin (mg) | 4.9995 | 0 | 15 |
| Vit B6 (mg) | 0.5 | 0 | 2 |
| Folate (mg) | 0.1 | 0 | 1 |
| Vit B12 (mg) | 0.0015 | 0 | 0.09 |
| Protein (g) | 20 | 0 | 100 |
| Fibre (g) | 5 | 0 | 20 |
| Total CHO (g) | 12 | 0 | 60 |
| Pan. Acid (mg) | 2.5 | 0 | 10 |
| Omega 3 (mg) | 100 | 0 | 1000 |
| Probiotic (10 ⁹ cfu) | 0 | 0 | 0 |
| Energy (kJ) | 620 | 0 | 4000 |

User preferences for flavour are also summarised in Table 2. In order to fulfil the requirements of a very sweet chocolate flavoured drink, the amount of chocolate in Mike's drink is set to 19.2 grams and the amount of Sucralose in the drink is set to 0.6 grams. The other drinks are similarly flavoured appropriately to the user preferences.

Penalty weightings and relative priorities for each user are also established according to their individual preferences and nutrition requirements, as described previously. Drinks can now be formulated using the optimisation algorithm. The composition of the drinks is shown in Table 8.

26

TABLE 8

| Composition | Levels of Components and Features | | | | |
|---------------------------------|-----------------------------------|---------|---------|---------|---------|
| | Sam | Mike | Matt | Carolyn | Sarah |
| Water (g) | 346.646 | 360.552 | 338.134 | 353.651 | 368.599 |
| Protein (g) | 22.5 | 18 | 27.5 | 18 | 12.527 |
| Fat (g) | 0.075 | 0.799 | 0.921 | 0.06 | 0.291 |
| Saturated fat (g) | 0.051 | 0.33 | 0.421 | 0.04 | 0.194 |
| Total CHO (g) | 27 | 15.629 | 27.001 | 22.505 | 14.248 |
| CHO, no fibre (g) | 19.273 | 10.062 | 20.572 | 15.701 | 9.248 |
| Fibre (g) | 7.727 | 5.067 | 5.929 | 6.804 | 5.001 |
| Complex CHO (g) | 0.058 | 0.032 | 0.058 | 0.107 | 2.475 |
| Sugar (g) | 19.215 | 9.278 | 20.513 | 13.048 | 6.475 |
| Lactose (g) | 0.198 | 9.863 | 14.349 | 2.705 | 6.78 |
| Ash (g) | 2.902 | 4.039 | 5.463 | 4.896 | 3.476 |
| Energy (kJ) | 831.801 | 593.011 | 947.439 | 679.319 | 459.226 |
| Energy-fat (kJ) | 2.807 | 30.115 | 34.703 | 2.247 | 10.963 |
| Ca (mg) | 267.158 | 708.287 | 998.757 | 553.916 | 550 |
| K (mg) | 1025.082 | 505.872 | 585.726 | 884.602 | 569.962 |
| P (mg) | 181.491 | 131.876 | 131.876 | 169.858 | 136.213 |
| Na (mg) | 54.576 | 2.304 | 0 | 43.676 | 0.74 |
| Cl (mg) | 5.074 | 0.112 | 0.112 | 4.081 | 0.111 |
| Fe (mg) | 0 | 0 | 0 | 4.95 | 0.088 |
| Mg (mg) | 109.025 | 101.334 | 103.697 | 105.163 | 106.36 |
| Zinc (mg) | 3.8 | 3.8 | 3.8 | 3.75 | 3.757 |
| Vit A (mg) | 0.086 | 0 | 0.028 | 0.058 | 0 |
| Vit C (mg) | 153.144 | 15.2 | 59.919 | 125.001 | 15.002 |
| Vit D (mg) | 0.003 | 0.003 | 0.003 | 0.003 | 0.003 |
| Vit E (mg) | 0 | 5 | 0 | 0 | 5 |
| Thiamin (mg) | 0.38 | 0.38 | 0.38 | 0.375 | 0.375 |
| Riboflavin (mg) | 0.431 | 0.431 | 0.431 | 0.425 | 0.425 |
| Niacin (mg) | 5.067 | 5.067 | 5.067 | 5.001 | 5.001 |
| Vit B6 (mg) | 0.507 | 0.507 | 0.507 | 0.5 | 0.5 |
| Folate (mg) | 0 | 0.1 | 0 | 0 | 0 |
| Vit B12 (mg) | 0.002 | 0.002 | 0.002 | 0.002 | 0.002 |
| Pan. Acid (mg) | 2.533 | 2.533 | 2.533 | 2.5 | 2.5 |
| Caffeine (mg) | 0 | 0 | 0 | 0 | 62.84 |
| Omega 3 (mg) | 0 | 100 | 100 | 0 | 0 |
| EPA + DHA (mg) | 0 | 80 | 80 | 0 | 0 |
| Probiotic (10 ⁹ cfu) | 0 | 0 | 0 | 5 | 0 |

Table 9 shows the calculated prices of the drinks for the five consumers using both Boolean-Tree and Optimisation methods. The output of the Optimisation algorithm provides similar nutritional content in each case (see Table 5 for levels of components/features in the output of the Boolean-Tree algorithm), at a much cheaper price.

TABLE 9

| Algorithm | Calculated Drink Price | | | | | | | | | |
|---------------|------------------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|
| | Sam | | Mike | | Matt | | Carolyn | | Sarah | |
| | Boolean-Tree | Optimisation | Boolean-Tree | Optimisation | Boolean-Tree | Optimisation | Boolean-Tree | Optimisation | Boolean-Tree | Optimisation |
| Price (cents) | 82.08 | 62.65 | 47.01 | 44.83 | 64.08 | 48.10 | 63.53 | 55.51 | 48.00 | 38.23 |

Solution Methods

The optimisation routine solves the optimisation problem thus formulated.

The optimisation is carried out using an optimisation algorithm or heuristic chosen in order to run as effectively as possible within a reasonable time frame. Since the capabilities of algorithms and the speed of computers are continually increasing, and the length of a reasonable time frame in which to run the optimisation algorithm or heuristic depends on the time between when the optimisation is used and the time at which the user is ready to receive the serving, and the complexity of the problem varies with the complexity of constraints and objective function criteria formulated in it, which may be changed from time to time, different embodiments of the invention may require different solution methods. The selection of possible solutions methods below is not intended to be limiting.

In one embodiment the objective function and all constraints are linear and the problem is thus a mixed integer linear program.

In one alternative the optimisation is carried out using mixed integer linear programming, as disclosed, for example, in Winston, W. L. (2004), *Operations Research: Algorithms and Applications*, 4th Edition, Duxbury Press, incorporated herein by reference.

In one alternative the simplex method is used to solve linear relaxations of the mixed integer program, as disclosed, for example, in Winston, W. L. (2004), *Operations Research: Algorithms and Applications*, 4th Edition, Duxbury Press, incorporated herein by reference.

In one alternative interior point methods are used to solve linear relaxations of the mixed integer program, as disclosed, for example, in Winston, W. L. (2004), *Operations Research: Algorithms and Applications*, 4th Edition, Duxbury Press, incorporated herein by reference.

In one alternative the optimisation is carried out using threshold acceptance, as disclosed, for example, in Dueck, G. and Scheuer, T. (1990), Threshold accepting: a general purpose optimization algorithm appearing superior to simulated annealing, *Journal of Computational Physics* 104 pp86-92, incorporated herein by reference.

In one alternative the optimisation is carried out using multistart, as disclosed, for example in Rinnooy Kan, A. H. G. And Timmer, G. (1984), A stochastic approach to global optimization, in *Numerical Optimization* (P. Boggs, R. Byrd and R. B. Schnabel, Eds.), SIAM, Philadelphia, incorporated herein by reference.

In one alternative the optimisation is carried out using simulated annealing, as disclosed, for example, in Kirkpatrick, S., Gelatt, C. D. Jr. And Vecchi, M. P. (1983), Optimization by simulated annealing, *Science* 220 pp671-680, incorporated herein by reference.

In one alternative the optimisation is carried out using the great deluge, as disclosed, for example, in Dueck, G. (1993), New optimization heuristics: the great deluge algorithm and the record-to-record travel, *Journal of Computational Physics* 104 pp86-92, incorporated herein by reference.

In one alternative the optimisation is carried out using tabu search, as disclosed, for example, in Glover, F. and Laguna, M. (1997), *Tabu Search*, Kluwer Academic Publishers, Boston, incorporated herein by reference.

In one alternative the optimisation is carried out using controlled random search, as disclosed, for example, in Price, W. L. (1978), A controlled random search procedure for global optimization, in *Towards Global Optimization 2* (L. C. W. Dixon and G. P. Szegö, Eds.), North-Holland, Amsterdam, incorporated herein by reference.

In one alternative the optimisation is carried out using genetic algorithms, as disclosed, for example, in Holland, J. H. (1975), *Adaptation in natural and artificial systems*, The University of Michigan Press, Ann Arbor, incorporated herein by reference.

In one alternative the optimisation is carried out using neural networks, as disclosed, for example, in Hopfield, J. J. and Tank, D. W. (1985), "Neural" computation of decisions in optimization processes, *Biological Cybernetics* 52 pp141-152, incorporated herein by reference.

In one alternative the optimisation is carried out using evolutionary algorithms, as disclosed, for example, in Rachev, I. (1973), *Evolution strategie: Optimierung technischer systeme nach prinzipien der biologischen evolution*, Frommann-Holzboog, Stuttgart, incorporated herein by reference.

In one alternative the optimisation is carried out using the Nelder-Mead algorithm, as disclosed, for example, in Nelder, J. A. and Mead, R. (1965), A simplex method for function minimization, *The Computer Journal* 7 pp308-313, incorporated herein by reference.

In one alternative the optimisation is carried out using particle swarms, as disclosed, for example, in Eberhart, R. C. and Kennedy, J. (1995), A new optimizer using particle swarm theory, *Proceedings of the Sixth International Symposium on Micromachine and Human Science*, Nagoya, Japan, pp 39-43, incorporated herein by reference.

In one alternative the optimisation is carried out using simulated ant colonies, as disclosed, for example, in Colomi A., Dorigo, M. and Maniezzo, V. (1992) Distributed Optimization by Ant Colonies, *Proceedings of the First European Conference on Artificial Life*, Paris, France (F. Varela and P. Bourguin, Eds.), Elsevier Publishing, pp134-142, incorporated herein by reference.

In one alternative the optimisation is carried out using gradient methods, as disclosed, for example, in Golub, G. and O'Leary, D. (1989), Some History of the Conjugate Gradient and Lanczos Methods, *SIAM Rev* 31, p50-102, incorporated herein by reference.

Although the present invention has been described in detail with reference to examples and particular embodiments above, it is understood that various modifications can be made without departing from the spirit of the invention. Accordingly, the invention is limited only by the following claims. All cited patents, patent applications and publications referred to in this application are herein incorporated by reference in their entirety.

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Golub, G. and O'Leary, D. (1989), Some History of the Conjugate Gradient and Lanczos Methods, SIAM Rev 31, p50-102.

What is claimed is:

1. A system for dispensing a customized nutritional serving which comprises:

- an ingredient storage module;
- an ingredient processing module;
- a serving dispenser;
- a customer interface; and
- a controller operatively linked to the customer interface and programmed to control the storage module, the processing module and the serving dispenser;
- the controller having stored in its memory an inventory of ingredients in the storage module, their compositions and their properties, and customer profile data;
- the controller being programmed to operate in the following manner:

when a customer selects a customized serving through the customer interface, the controller:

- a) looks up the information stored in its memory, formulates a serving which best matches the customized serving selected by the customer within predetermined constraints set by its programming and presents a selected serving to the customer for confirmation or modification;
- b) if the customer modifies the selection, repeats step a) on the modified selection, and presents the resulting selected serving to the customer for confirmation or modification; and
- c) when the customer has confirmed a serving issues instructions to the ingredient storage and processing modules and the serving dispenser to prepare and dispense the serving.

2. The system as claimed in claim 1, wherein the ingredient processing module and the serving dispenser are integral with one another.

3. The system as claimed in claim 1, wherein the serving dispenser is at least partly operated by a customer or by an operator.

30

4. The system as claimed in claim 1, wherein the predetermined constraints in the programming of the controller include but are not limited to one or more of the following:

- limitations on physical properties of ingredients,
- the compatibility of ingredients with one another,
- limitations on certain ingredients by health status,
- requirements of certain ingredients by health status,
- availability of ingredients in the inventory, and cost.

5. The system as claimed in claim 1, wherein the controller is programmed so that as if a repeat customer is identified through the customer interface, the customer is presented with a selected serving based on a previous selection of that customer, and if the customer confirms the selection the controller skips directly to step c), while if the customer selects a different serving the controller begins at step a).

6. The system as claimed in claim 1, wherein in carrying out steps a) and b) the controller:

- uses the customer profile data to generate nutritional requirements and targets for the customer and consults the inventory of ingredients to generate limits on the inclusion levels of each ingredient, and
- selects ingredients to formulate a serving optimised to meet nutritional requirements within the constraints of available ingredients.

7. The system as claimed in claim 6, wherein the controller selects ingredients to formulate a serving optimised to meet nutritional requirements within the constraints of other requirements.

8. The system as claimed in claim 7, wherein the other requirements include requirements that certain ingredients are not included together at incompatible levels and that the serving comprises sufficient but not excessive liquid ingredients in a way that departs as little as possible from nutritional targets, that matches as closely as possible the customer's preferred flavour choices, and that is as inexpensive as possible.

9. The system as claimed in claim 1, wherein in the steps a) and b) the selected serving presented to the customer is determined through the use of a boolean-tree algorithm.

10. The system as claimed in claim 6, wherein in the steps a) and b) the selected serving presented to the customer is determined through the use of mixed integer linear programming.

11. A system as claimed in claim 1, wherein the ingredient storage module comprises a plurality of storage compartments.

12. A system as claimed in claim 1, wherein the ingredients storage module contains a dosing means for dosing predetermined amounts of ingredients stored in compartments into a serving.

13. A system as claimed in any claim 1, wherein there is provided ingredient advancing means for moving ingredients from the ingredients storage module to the ingredient processing module.

14. A system as claimed in claim 1, wherein the controller is operatively linked to one or more servers each having stored in its memory at least some of the inventory of ingredients in the storage module and possible servings available therefrom, nutritional and health data relating to ingredients in the storage module and possible servings therefrom, and at least some of the customer profile data.

15. A system as claimed in claim 14, wherein the controller and/or server is operatively linked to an external database.

16. A system as claimed in claim 15, wherein the external database contains information on health and nutrition.

US 7,762,181 B2

31

17. A system as claimed in claim 15, wherein the external database contains health information of a customer.

18. A system as claimed in claim 1, wherein the customer profile data includes health status, records of recent purchases and preferences.

19. A system as claimed in claim 1, wherein the customer interface is a touch panel or keyboard integral with the dispensing system.

20. A system as claimed in claim 1, wherein the customer interface is a cell phone operable from a location remote from the dispensing system.

21. A system as claimed in claim 1, wherein the customer interface is a customer computer operatively linked through to the internet to the system.

32

22. A system as claimed in claim 1, wherein the customer interface is a card reader which reads information digitally or magnetically stored on a card presented by a customer.

23. A system as claimed in claim 1, wherein the controller is operatively linked to a billing function.

24. A system as claimed in claim 23, wherein the billing function is operatively linked to an electronic crediting/debiting system.

25. A system as claimed in claim 23, wherein the billing function is actuatable by the insertion of coins, banknotes, prepaid electronic cards or the like.

26. A network of systems as claimed in claim 1, operatively linked to one or more servers.

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US007184704B2

(12) **United States Patent**
Kliland et al.

(10) **Patent No.:** **US 7,184,704 B2**
(45) **Date of Patent:** **Feb. 27, 2007**

(54) **ARRANGEMENTS AND METHODS FOR
REMOTE CONFIGURATION OF PERSONAL
EQUIPMENT VIA WIRELESS DETECTION
OF USER-ID**

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(73) Assignee: **Telefonaktiebolaget LM Ericsson**
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(65) **Prior Publication Data**

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Primary Examiner—Edan Orgad

(74) Attorney, Agent, or Firm—Nixon & Vanderhye P.C.

(30) **Foreign Application Priority Data**

Oct. 27, 2000 (NO) 20005440

(57) **ABSTRACT**

(51) **Int. Cl.**
H04B 7/00 (2006.01)

(52) **U.S. Cl.** **455/41.2**; 455/418; 455/419;
455/557; 455/558

(58) **Field of Classification Search** 455/41.2,
455/418, 419, 557, 558; 713/1, 100, 184,
713/185

See application file for complete search history.

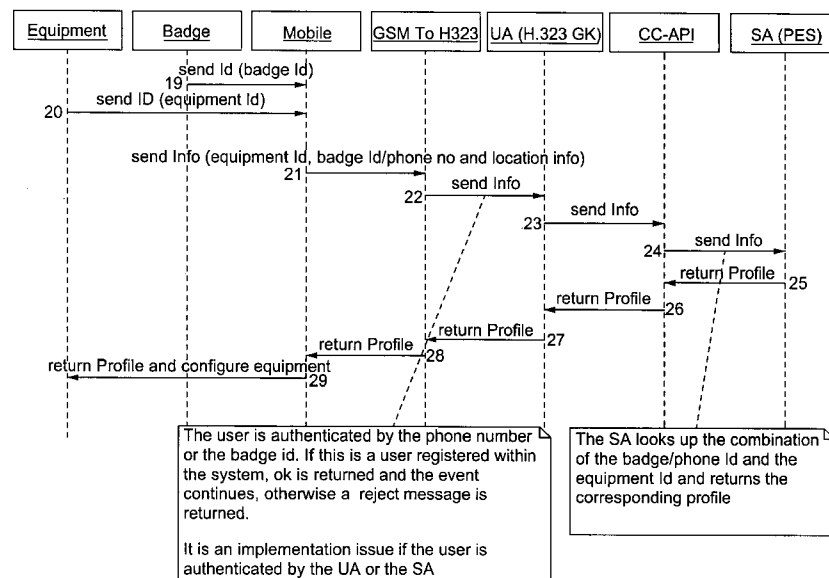
An arrangement and method for equipment remote control according to a predetermined user profile. Controllable equipment is provided with a first wireless communication device. A user identity badge is provided with a second wireless communication device for communication, when in-range, with the first wireless communication device. A mobile communication terminal in communication with an Internet Protocol (IP) network, and provided with a third wireless communication device, communicates, when in-range, with the second wireless communication device. User and equipment identities are communicated to a user profile server connected to the IP network, and a user profile is returned to the equipment which is configured accordingly.

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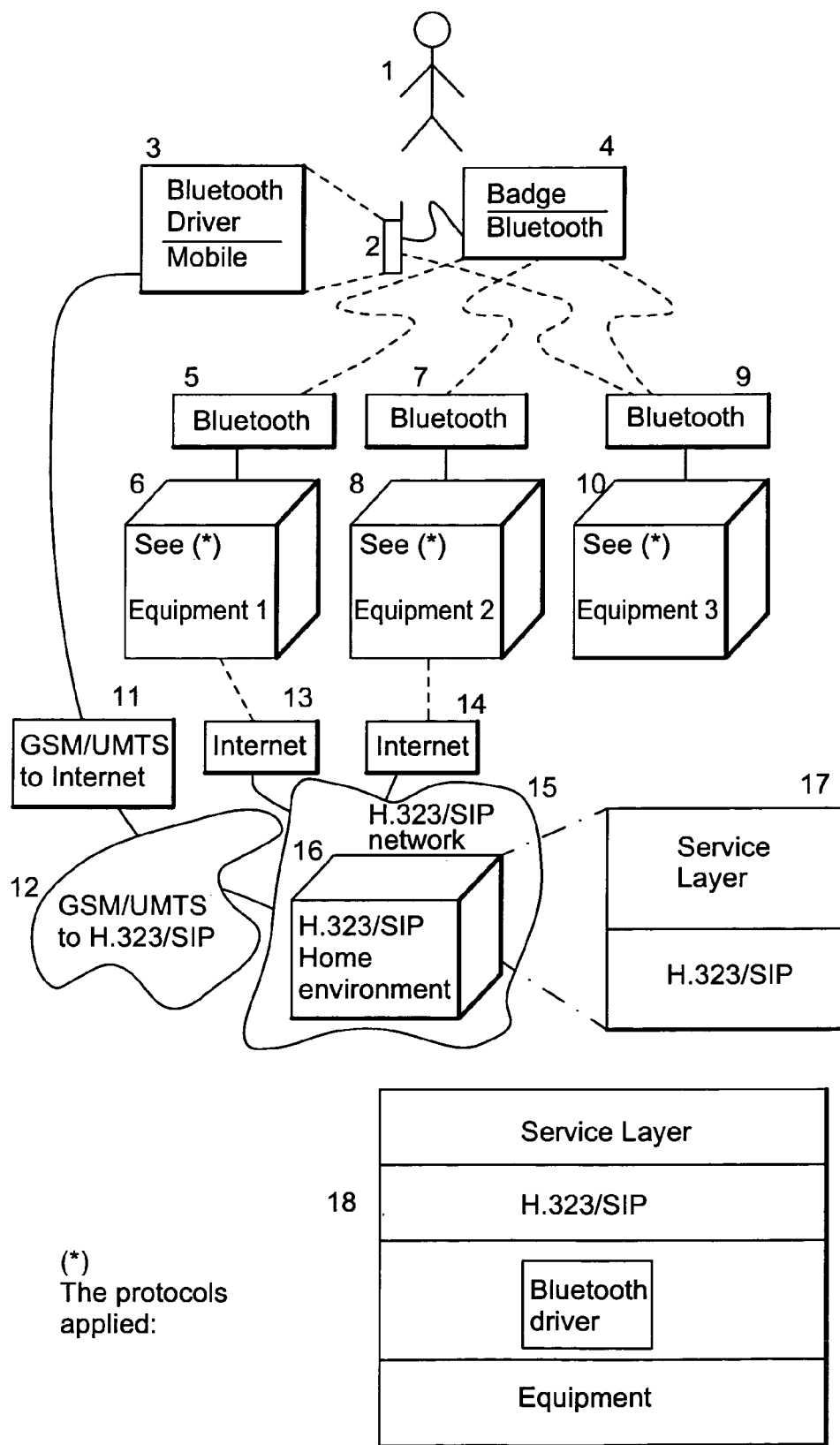


Fig. 1

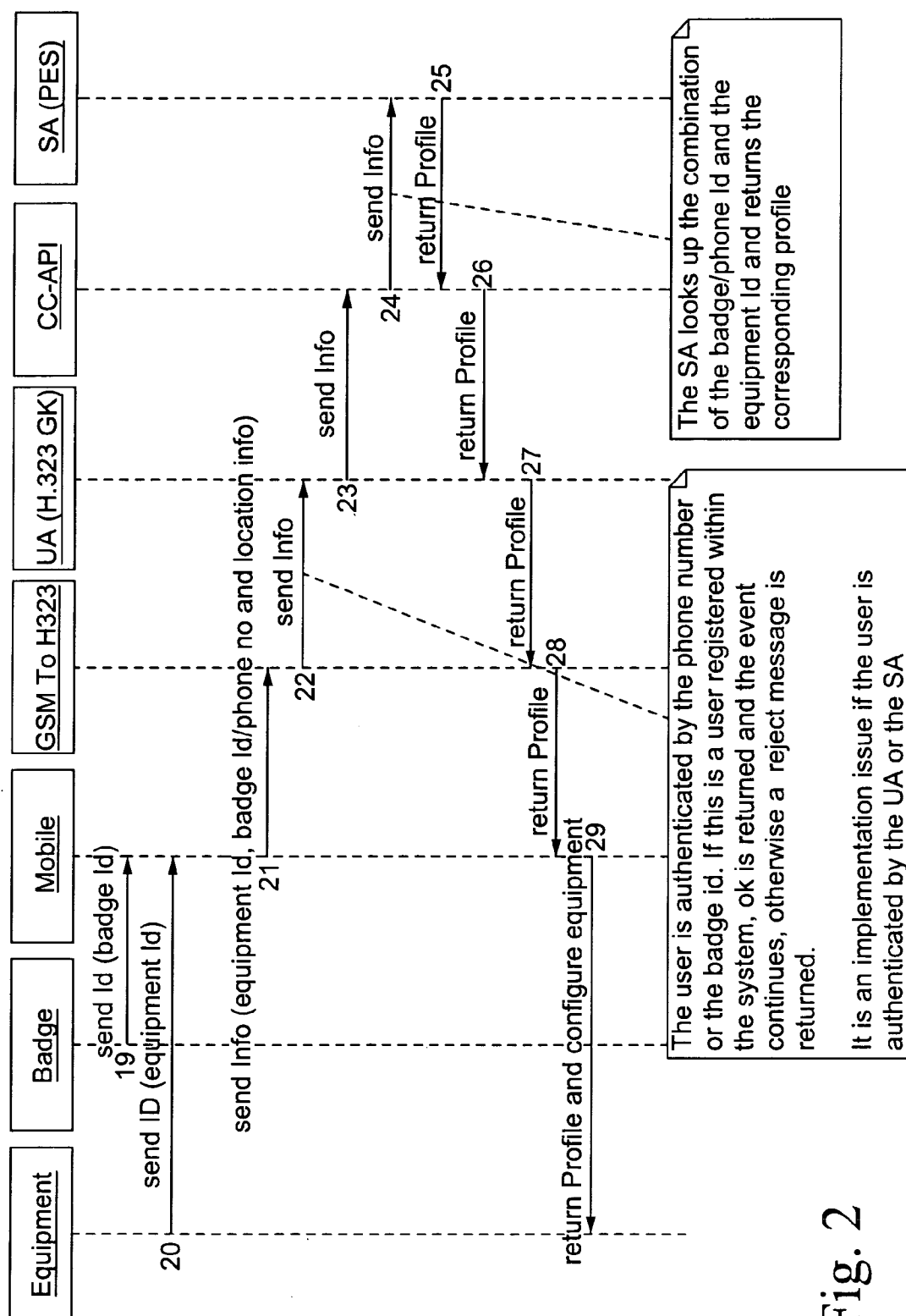


Fig. 2

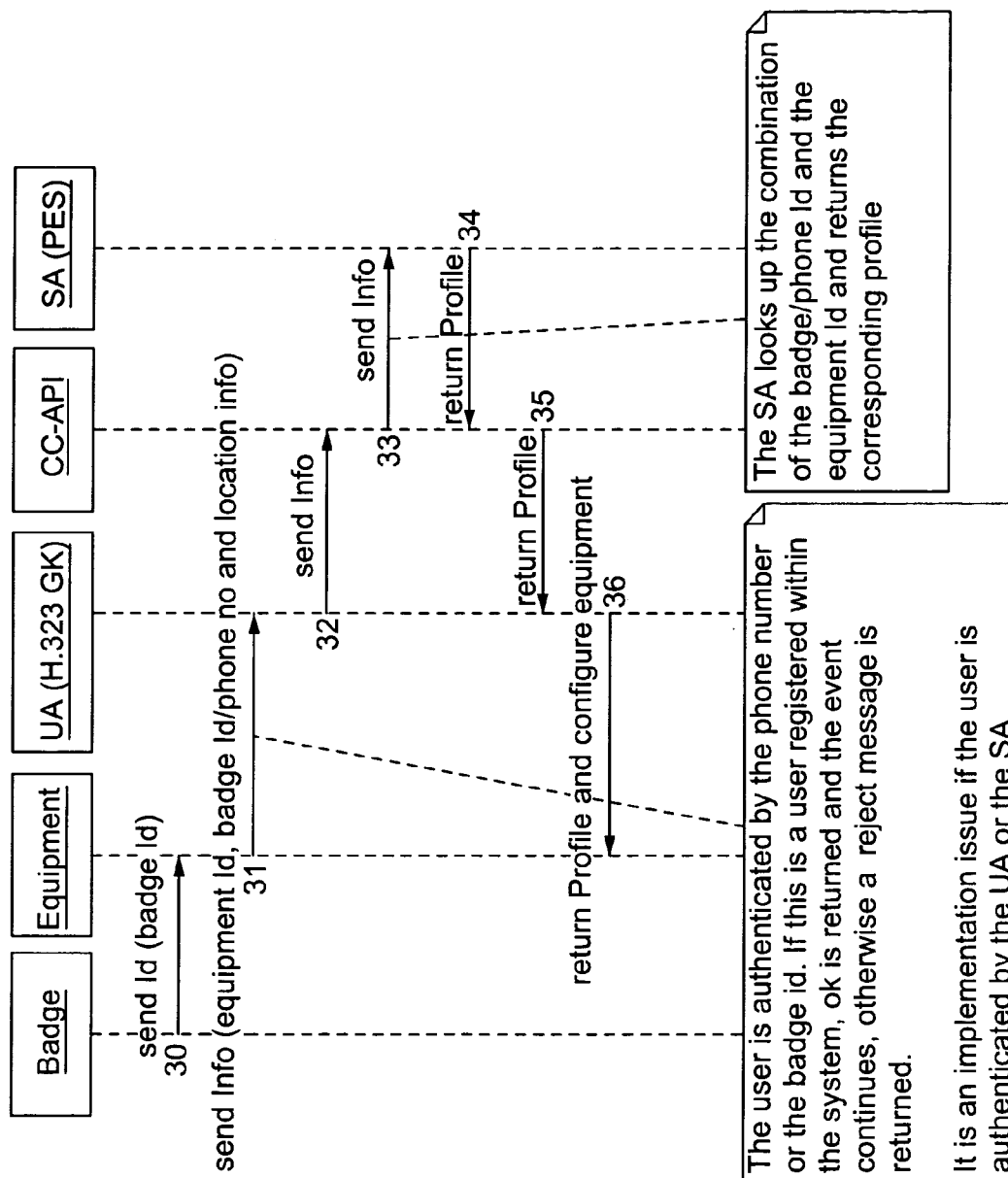


Fig. 3

US 7,184,704 B2

1

ARRANGEMENTS AND METHODS FOR REMOTE CONFIGURATION OF PERSONAL EQUIPMENT VIA WIRELESS DETECTION OF USER-ID

FIELD OF THE INVENTION

The present invention relates to arrangements and a methods for remotely configuring personal equipment, and particularly to such arrangements and methods that employ wireless technology.

BACKGROUND

Mobile people might like to configure equipment they access to fit their individual needs in an easy way. The equipment could be configured manually. Another approach could use badges or active badges that identify a person with a personal badge towards the equipment which is to be operated. But manual configuration is often quite time consuming and tedious. A problem with plain active badges is that each equipment has to be configured manually according to each person's need, i.e., a certain instance of an equipment has to be configured manually for each person that later might use the equipment.

Other issues that not are covered by these approaches include:

Badge and user authentication as well as general security aspects such as encryption and integrity.

How to charge for such services?

How may an operator provide such services to its customers?

How may an operator provide badge-related services?

QoS (Quality Of Service), e.g., what bandwidth should be set-up from the network towards the operable equipment?

SUMMARY

An arrangement for automatic equipment remote control according to a predetermined user profile, comprises: a user identity badge provided with a first wireless communication device having a first identifier, controllable equipment automatically responsive to a user profile and provided with and connected to a second wireless communication device having a second identifier, a mobile communication terminal adapted to communicate by an Internet Protocol (IP) network, said mobile communication terminal being provided with and connected to a third wireless communication device having a third identifier, and a user profile server connected to said IP network and holding the predetermined user profile, wherein said first, second and third wireless communication devices are adapted to communicate with one another, said first wireless communication device is adapted to communicate to said second wireless communication device, when in-range, the first identifier, said second wireless communication device is adapted to communicate to said third wireless communication device, when in-range, the first and second identifiers, the mobile equipment is adapted to communicate to the user profile server the first, second and third identifiers, and the user profile server is adapted to communicate to the controllable equipment, via the mobile terminal, the third wireless device and second wireless device, on basis of the second and third identifiers, the predetermined user profile in response to receiving the first and second identifiers.

2

The mobile communication terminal may be enabled to communicate to said user profile server, via said IP network, a user identifier received from said user identity badge, and an equipment identifier received, optionally via said user identity badge, from said equipment. The user profile server may be enabled to communicate via said IP network and said mobile communication terminal and, optionally, via said user identity badge, the predetermined user profile to the identified equipment in response to receiving said user identifier and equipment identifier. The predetermined user profile may be stored in a memory of said user profile server.

An arrangement for automatic equipment remote control according to a predetermined user profile, comprises: a user identity badge provided with a first wireless communication device having a first identifier, controllable equipment automatically responsive to a user profile, said controllable equipment provided with and connected to a second wireless communication device having a second identifier, and connected to an Internet Protocol (IP) network, and a user profile server connected to said IP network and holding the predetermined user profile, wherein, said first and second wireless communication devices are adapted to communicate with one another, said first wireless communication device is adapted to communicate to said second wireless communication device, when in-range, the first identifier, said controllable equipment is adapted to communicate to the user profile server, via the Internet Protocol (IP) network, the first and second identifiers, and the user profile server is adapted to communicate to the controllable equipment, via the Internet Protocol (IP) network, on basis of the second identifier, the predetermined user profile in response to receiving the first and second identifiers.

The equipment may be enabled to communicate an equipment identifier and a user identifier received from the user identity badge to said user profile server. The user profile server may be enabled to communicate the predetermined user profile to said equipment in response to receiving said user identifier and equipment identifier. The IP network may be a multimedia network, a H.323 network or a SIP network. The first and second wireless communication devices may be Bluetooth enabled wireless communication devices.

A method for automatic equipment remote control according to a predetermined user profile, comprises: wirelessly communicating a user identifier from a user identity badge to a mobile communication terminal, wirelessly communicating an equipment identifier from an equipment to be controlled to a mobile communication terminal, forwarding from said mobile communication terminal, via a gateway to an IP network, a first information set including said user identifier and equipment identifier and/or a mobile terminal identifier to a User Agent (UA) in an Internet Protocol network, forwarding from said UA said first information set, via a Call Control API (CC-API), to a Service Agent (SA), returning from said SA a second information set including said predetermined user profile, via said Call Control API (CC-API), to said UA, forwarding from said UA said second information set, via a gateway to a mobile communication network, to said mobile communication terminal, wirelessly communicating from said mobile communication terminal said second information set to said equipment, and configuring said equipment according to said predetermined user profile.

A method for automatic equipment remote control according to a predetermined user profile, comprises: wirelessly communicating a user identifier from a user identity badge to an equipment, forwarding from said equipment said user identifier and an equipment identifier to a User

US 7,184,704 B2

3

Agent (UA) in an Internet Protocol (IP) network, forwarding from said UA information including said user identifier and equipment identifier, via a Call Control API (CC-API), to a Service Agent (SA), returning from said SA information including said predetermined user profile, via said Call Control API (CC-API), to said UA, forwarding from said UA said predetermined user profile to said equipment, and configuring said equipment according to said predetermined user profile. The mobile terminal may be a mobile telephone, and said mobile terminal identifier may include a telephone number of said mobile telephone.

BRIEF DESCRIPTION OF THE DRAWINGS

In the following, the invention will be described by way of example, and illustrations thereof in the accompanying drawings, in which:

FIG. 1 shows a schematic representation of an example of an arrangement according to the invention illustrating how personal settings easily might be applied to equipment;

FIG. 2 shows an exemplary sequence diagram for an example of the sequence flow of the personal equipment service according to the invention illustrated by using a H.323 network applicable to a situation where the equipment is not connected to the internet; and

FIG. 3 shows an exemplary sequence diagram for an example of the sequence flow of the personal equipment service according to the invention illustrated by using a H.323 network applicable to a situation where the equipment is connected to the Internet.

DETAILED DESCRIPTION

Now, referring to FIG. 1, an example situation is shown where a person has arrived at a location, where different equipments 6, 8 and 10 are located, and which equipments the person 1 (user) wants to personalize, meaning that the person wants to configure equipment at the location according to her/his personal needs, wishes or requirements. The equipments 6, 8 and 10, could be any controllable or configurable device, such as for instance a communication terminal (for example SIP or H.323), a video or sound player, etc. In this example, two situations are shown:

- a) One where the equipment is connected to the Internet; and
- b) one where the equipment is not connected to the Internet.

In FIG. 1, "equipment 1" 6 and "equipment 2" 8 exemplify the situation where the equipment is connected to the Internet, while "equipment 3" 10 exemplify the situation where equipment is not connected to the Internet. Depending on the collection of parameters, of which at least one parameter is a personal identification (Id), transmitted from the user by the mobile phone terminal 2 to the home environment 16, a corresponding personal equipment configuration profile is forwarded to the equipment 6, 8, 10, and the equipment 6, 8, 10 is configured accordingly. In the home environment 16, a call control API is located in-between the service layer and the H.323/SIP layer, as illustrated by the block assigned reference numeral 17. A badge Id associated with badge 4 is a personal Id, and is directly connected to the identity of a particular user.

The home environment 16 is a location where the user 1 keeps or stores her/his profiles according to e.g. GSM's Home Location Register (HLR). The home environment 16 includes an electronic memory to hold or store the personal profiles, the memory preferably being an electronic database

4

(DB) system. In situations where the network is H.323 enabled, preferably an H.323 gatekeeper is providing the services of the home environment 16. However, in a SIP enabled network, preferably a SIP server would perform these tasks.

In the following, a few examples of equipment and advantages of the solution provided by the present invention are presented. It should be kept in mind that authentication, security etc. are inherent to and provided by a H.323 (or SIP) enabled network, and therefore, will greatly enhance a system according to the invention. In a first example, the equipment, such as e.g. one or more of equipments 6, 8 or 10 shown in FIG. 1, is a multimedia terminal. The home environment can be updated with information about the current location of the user, for the purpose of e.g. redirecting every invoke to the user towards the multimedia terminal. Since a multimedia terminal typically has better capabilities than the mobile phone terminal 2, the user may prefer to use the multimedia terminal instead of the mobile phone terminal. This service provided by a system is referred to as a multi-terminal service.

In a second example, the operation of the equipment is software based depending on the parameters transmitted from the user's terminal 2 to the home environment 16. Corresponding software is forwarded to the equipment 6, 8 or 10, installed, and put into operation to obtain the required equipment functions, capabilities and/or properties. In a third example, the equipment 6, 8 or 10 is a video or sound player. Depending on the badge Id transmitted from the badge 4 and forwarded to the home environment 16, the corresponding favourite video and/or sound programming is forwarded to the equipment 6, 8 or 10 to be enjoyed by the user 1. In the three examples above, the industry standard wireless Bluetooth technology may be used, but it will be understood that other wireless technologies may be utilized in a system according to the invention.

A Personal Equipment Service (PES) function allocated in the Service Node 15 of a H.323 (or SIP) based network may serve the requests for the user-specific or tailor-made equipment profile to be downloaded. Other services existing might interact with the PES service.

The following example relates to an arrangement where the equipment is not connected to Internet. In this example, reference is only made to H.323, but the network utilized also be some other IP enabled network, such as e.g. a SIP based network.

FIG. 2 shows a sequence example of an example method, preferably employed in a system like the system shown in FIG. 1 comprising equipment to be controlled that is not connected to the IP network. A mobile phone terminal is used for downloading personal profiles or settings in order to configure the equipment according to personal needs. The badge Id and the equipment Id are in steps 19 and 20, respectively, transferred by respective short-range wireless devices, such as e.g. Bluetooth technology devices, to the mobile phone terminal when these are within range of each other. In step 21, the mobile phone terminal transmits a set of information comprising its own Id and/or the mobile phone number, the received badge Id and equipment Id, and, optionally, location information, and through steps 22, 23 and 24, the set of information is transferred to the home environment in order to identify the person and the equipment to be configured to the requirements of the user. The personal profiles or settings, preferably stored in the home environment, are then through steps 25, 26, 27 and 28 forwarded from the home environment, by means of the network, to the mobile phone terminal. In turn, the mobile

US 7,184,704 B2

5

phone terminal, in step 29, forwards by short-range wireless means, such as e.g. Bluetooth technology devices, the profile to the equipment and which then is configured accordingly. It will be readily apparent to a person skilled in the art that the technology of the mobile phone terminal is not limiting for the invention, and that the mobile phone terminal in this situation can be based on any known or coming mobile phone technology (GSM, UMTS etc.) that is capable of communicating with a network and having an interface adapted to forward electronically to a short-range wireless device, information received via the network. It will also be understood that the location information can be used for triggering location dependent services provided by the equipment to be controlled, by the profile or settings provided by the home environment and intended for the equipment.

As can be seen from FIG. 1, a wireless device 3, such as e.g. a Bluetooth technology device, that is enabled for and potentially able to convey and/or forward the badge Id to the home environment, is associated with and connected to the mobile phone terminal 2. Accordingly, the equipment, exemplified in FIG. 1 by equipments 6, 8 and 10, included in an arrangement employing the invention, are each in communication with a corresponding a wireless device, such as e.g. a Bluetooth technology device, 5, 7 and 9, respectively. The arrangement shown by the example of FIG. 1 also comprises a gateway (GW) function 11, 12 between the Public Land Mobile Network (PLMN) and the H.323 network. For security purposes, GSM information is for example encrypted so as to maintain the security within the PLMN network, while the H.323 network can provide corresponding security connections. In the H.323 network, a H.323 gatekeeper (UA) (not shown in FIG. 1, but illustrated by the sequence diagrams of FIGS. 2 and 3) is communicating with the Service Agent (SA) (referred to as the "service layer" in FIG. 1) running the Personal Equipment Service (PES) over a call control API (CC-API). The CC-API can be any suitable CC-API, such as a proprietary type, a Telephone Application Interface (TAPI), Parly, etc. The H.323 GK (UA) is responsible for charging the user, i.e. for sending Call Detail Records (CDRs) to a known billing server (not shown) of the network, as well as for authenticating the user. If a quality of service (QoS) is specified and/or required, the UA can also be responsible for setting up a connections from the UA towards the equipment with a certain QoS. The SA is referred to as the service layer in FIG. 1.

In an alternative embodiment, the badge 4 can be incorporated into the mobile communication terminal 2.

FIG. 3 shows a method where the equipment is connected to Internet. Examples of such equipment with connection to the Internet are also illustrated in FIG. 1 by equipments represented by "equipment 1" 6 and "equipment 2" 8. Further, in this example, reference is only made to H.323, but the network could but the network utilised in a system according to the invention could also be some other IP enabled network, such as e.g. a SIP based network.

With reference to FIG. 3, the mobile phone can be regarded superfluous in this case. An Internet connection 13, 14 linking the equipment 6,8 with the Internet can be used for both sending and receiving the badge Id and the personal profiles, or settings, respectively, between the equipment 6,8 and the home environment 16. In this case, where the equipment is connected to the Internet, the sequence flow shown in FIG. 3 is only in part like the sequence described in the previous explanation with reference to FIG. 2. In FIG. 3, if the equipment to be controlled or configured is H.323

6

adapted, then the HTTP service channel (see specification H.323, Annex K) can be used for sending the badge Id from the badge 4 to the equipment 6 or 8, via the equipment associated wireless device 5 or 7, respectively, and receiving the equipment profiles. A personal wireless electronic badge, in step 30, when coming into range of a wireless device connected to equipment to be controlled, sends its Id to the equipment. In steps 31, 32 and 33, a set of information including the badge Id, equipment Id and, if available, location information is forwarded via the network from the equipment to the home environment represented by the SA (PES). In turn, the SA looks up the combination of badge Id and equipment Id, and, if a profile or equipment setting corresponding to the information set is found. In steps 34, 35 and 36, the profile or equipment settings is forwarded via the network directly from the SA (PES) to the equipment. On receiving the profile, the equipment is configured accordingly. In this example, authentication and/or access control is provided by the UA or SA, depending on the actual implementation.

Alternatively, as a variant of combining parts of the sequences illustrated in FIGS. 2 and 3, an arrangement according to steps 19 through 24 can use a mobile phone terminal for transferring the information set, via the network, to the home environment (or SA (PES)), while the corresponding profile is transferred according to steps 34 through 36 via an Internet connection directly from the home environment (or SA (PES)) to the equipment.

Without a mobile telephone terminal, the location info is in the case illustrated by FIG. 3, not as easily transferred as in the case illustrated by FIG. 2 using a mobile phone. This is because, when it comes to Internet based equipment, no well known technology mapping IP address etc. to location is available, while, when using a mobile phone, the mobile phone can be used for obtaining and/or providing location information.

The invention reduces personal efforts in configuration of personal equipment. This is particularly advantageous when the equipment is used by many different persons requiring different equipment configurations or settings, and also when the equipment is used frequently by the same persons.

The invention claimed is:

1. An arrangement for automatic equipment remote control according to a predetermined user profile, comprising:
 - a user identity badge provided with a first wireless communication device having a first identifier,
 - controllable equipment automatically responsive to a user profile and connected to a second wireless communication device having a second identifier,
 - a mobile communication terminal adapted to communicate by an Internet Protocol (IP) network and connected to a third wireless communication device having a third identifier, and
 - a user profile server connected to said IP network and holding the predetermined user profile,
 wherein,
 - said first, second, and third wireless communication devices are adapted to communicate wirelessly with one another,
 - said first wireless communication device is adapted to communicate to said second wireless communication device the first identifier,
 - said second wireless communication device is adapted to communicate to said third wireless communication device the first and second identifiers,

US 7,184,704 B2

7

the mobile equipment is adapted to communicate to the user profile server the first, second and third identifiers, and

the user profile server is adapted to communicate to the controllable equipment, via the mobile terminal, the third wireless device and second wireless device, on basis of the second and third identifiers, the predetermined user profile in response to receiving the first and second identifiers.

2. The arrangement of claim 1, wherein said mobile communication terminal is enabled to communicate to said user profile server, via said IP network, a user identifier received from said user identity badge, and an equipment identifier received, optionally via said user identity badge, from said equipment.

3. The arrangement of claim 2, wherein said user profile server is enabled to communicate, via said IP network and said mobile communication terminal and, optionally, via said user identity badge, the predetermined user profile to the identified equipment in response to receiving said user identifier and equipment identifier.

4. The arrangement of claim 1, wherein said predetermined user profile is stored in a memory of said user profile server.

5. The arrangement of claim 1, wherein said IP network is a multimedia network, a H.323 network, or a SIP network.

6. The arrangement of claim 1, wherein the first and second wireless communication devices are short range wireless digital communication devices.

7. An arrangement for automatic equipment remote control according to a predetermined user profile, comprising: a user identity badge provided with a first wireless communication device having a first identifier,

controllable equipment automatically responsive to a user profile and connected to a second wireless communication device having a second identifier and connected to an Internet Protocol (IP) network, and a user profile server connected to said IP network and holding the predetermined user profile, wherein:

said first and second wireless communication devices are adapted to communicate wirelessly with one another, said first wireless communication device is adapted to communicate to said second wireless communication device the first identifier,

said controllable equipment is adapted to communicate to the user profile server, via the Internet Protocol (IP) network, the first and second identifiers, and the user profile server is adapted to communicate to the controllable equipment, via the Internet Protocol (IP) network, on basis of the second identifier, the predetermined user profile in response to receiving the first and second identifiers.

8. The arrangement of claim 7, wherein said equipment is enabled to communicate an equipment identifier and a user identifier received from the user identity badge to said user profile server.

9. The arrangement of claim 8, wherein said user profile server is enabled to communicate the predetermined user profile to said equipment in response to receiving said user identifier and equipment identifier.

10. The arrangement of claim 9, wherein said predetermined user profile is stored in a memory of said user profile server.

11. A method for equipment remote control according to a predetermined user profile, comprising:

8

wirelessly communicating a user identifier from a user identity badge to a mobile communication terminal, wirelessly communicating an equipment identifier from an equipment to be controlled to the mobile communication terminal,

forwarding from said mobile communication terminal, via a gateway to an IP network, a first information set including said user identifier and equipment identifier to a User Agent (UA) in an Internet Protocol network, forwarding from said UA said first information set, via a Call Control API (CC-API), to a Service Agent (SA), returning from said SA a second information set including said predetermined user profile, via said Call Control API (CC-API), to said UA,

forwarding from said UA said second information set, via a gateway to a mobile communication network, to said mobile communication terminal, wirelessly communicating from said mobile communication terminal said second information set to said equipment, and configuring said equipment according to said predetermined user profile.

12. The method of claim 11, wherein said mobile terminal is a mobile telephone, and said mobile terminal identifier includes a telephone number of said mobile telephone.

13. The method of claim 11, wherein said IP network is a multimedia network, a H.323 network or a SIP network.

14. The method of claim 11, wherein wirelessly communicating is performed by of a short range wireless digital communications device.

15. Apparatus for automatic equipment remote control according to a predetermined user profile, comprising:

means for wirelessly communicating a user identifier from a user identity badge to a mobile communication terminal,

means for wirelessly communicating an equipment identifier from an equipment to be controlled to the mobile communication terminal,

means for forwarding from said mobile communication terminal, via a gateway to an IP network, a first information set including said user identifier and equipment identifier to a User Agent (UA) in a Internet Protocol network,

means for forwarding from said UA said first information set, via a Call Control API (CC-API), to a Service Agent (SA),

means for returning from said SA a second information set including said predetermined user profile, via said Call Control API (CC-API), to said UA,

means for forwarding from said UA said second information set, via a gateway to a mobile communication network, to said mobile communication terminal,

means for wirelessly communicating from said mobile communication terminal said second information set to said equipment, and

means for configuring said equipment according to said predetermined user profile.

16. The apparatus of claim 15, wherein said mobile terminal is a mobile telephone, and said mobile terminal identifier includes a telephone number of said mobile telephone.

17. The apparatus of claim 15, wherein said IP network is a multimedia network, a H.323 network or a SIP network.

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(12) **United States Patent**
Simerly et al.

(10) **Patent No.:** **US 6,954,859 B1**
(45) **Date of Patent:** **Oct. 11, 2005**

(54) **NETWORKED DIGITAL SECURITY SYSTEM
AND METHODS**

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(52) **U.S. Cl.** **713/201; 725/108; 709/232**

(58) **Field of Search** **713/201; 348/839,**
348/150, 154, 169, 207.99; 709/232; 715/716,
715/719; 725/108, 126

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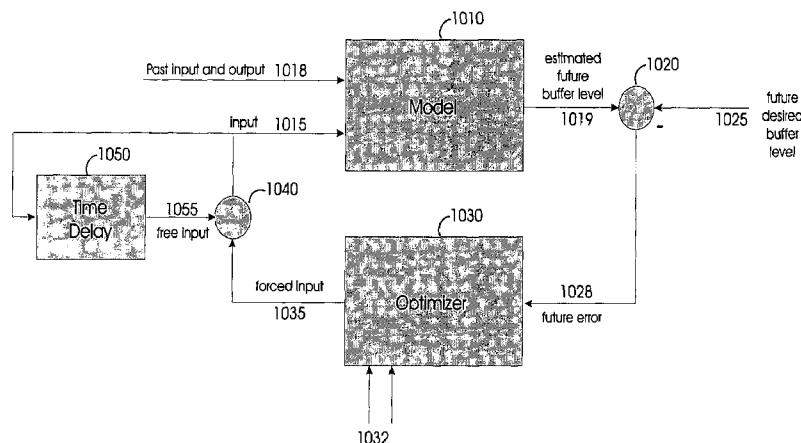
Primary Examiner—Justin T. Darrow

(74) *Attorney, Agent, or Firm*—Alston & Bird LLP

(57) **ABSTRACT**

A networked digital security system is disclosed that preferably includes a centralized administrator web server coupled via a communication network such as the Internet to a plurality of customer servers and a plurality of customer work stations. The centralized web server advantageously provides a point of control and management of the networked digital security system. The customer servers and customer work stations are preferably located at the customer's monitored sites. The customer servers are coupled to one or more intelligent camera units, which are preferably fully integrated intelligent units that gather, analyze, and transmit video, audio, and associated detected alarm event information to their associated customer server and the administrator web server. The camera units also include an intelligent automatic gain controller, an encoder buffer controller, and a network bandwidth priority controller. The system supports several compression algorithm standards.

39 Claims, 13 Drawing Sheets



US 6,954,859 B1

Page 2

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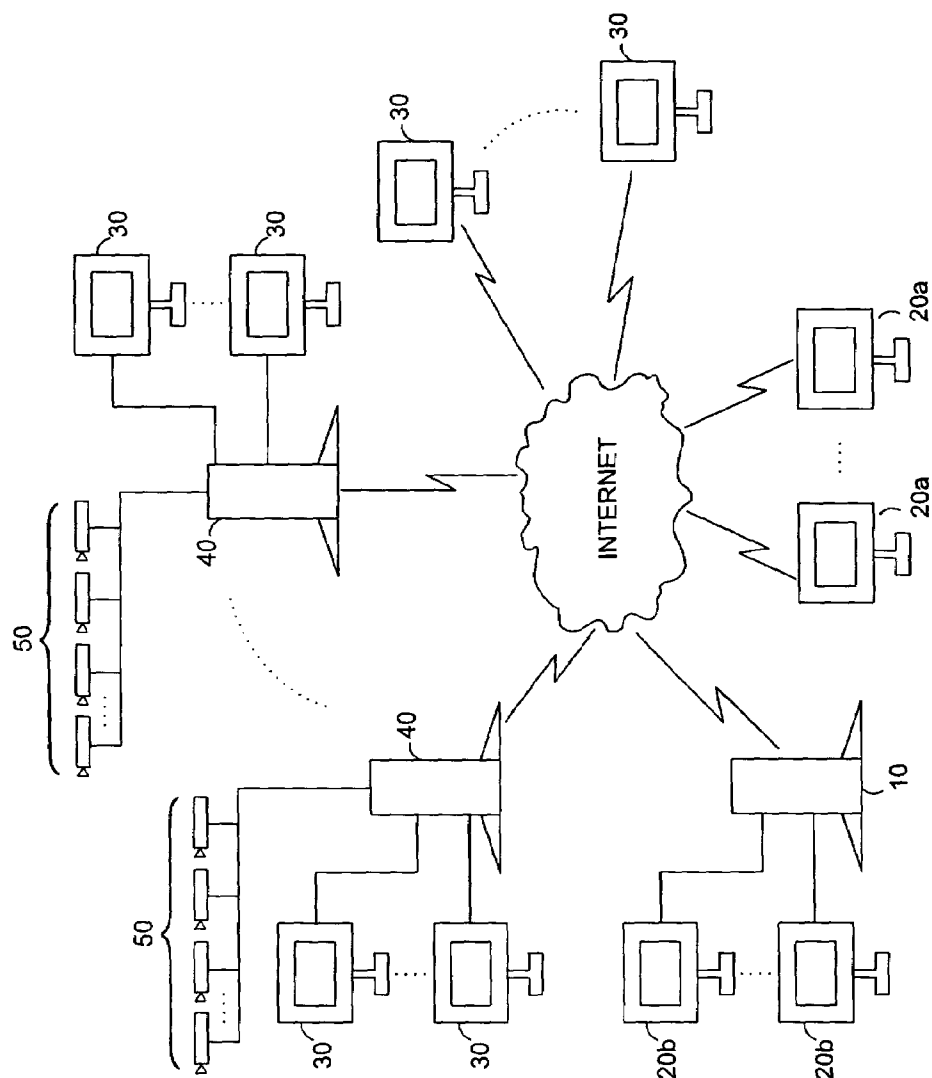


FIG. 1

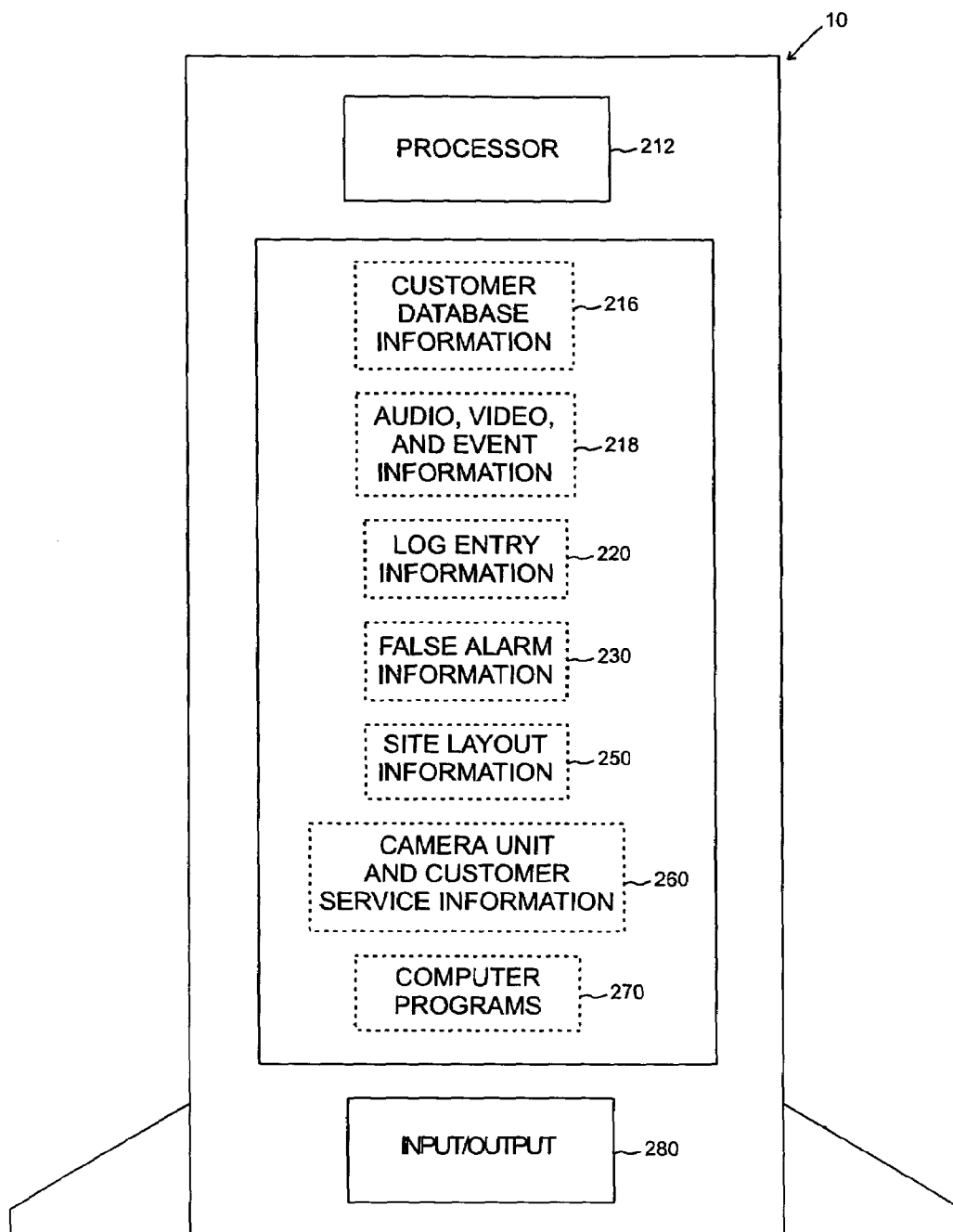


FIG. 2

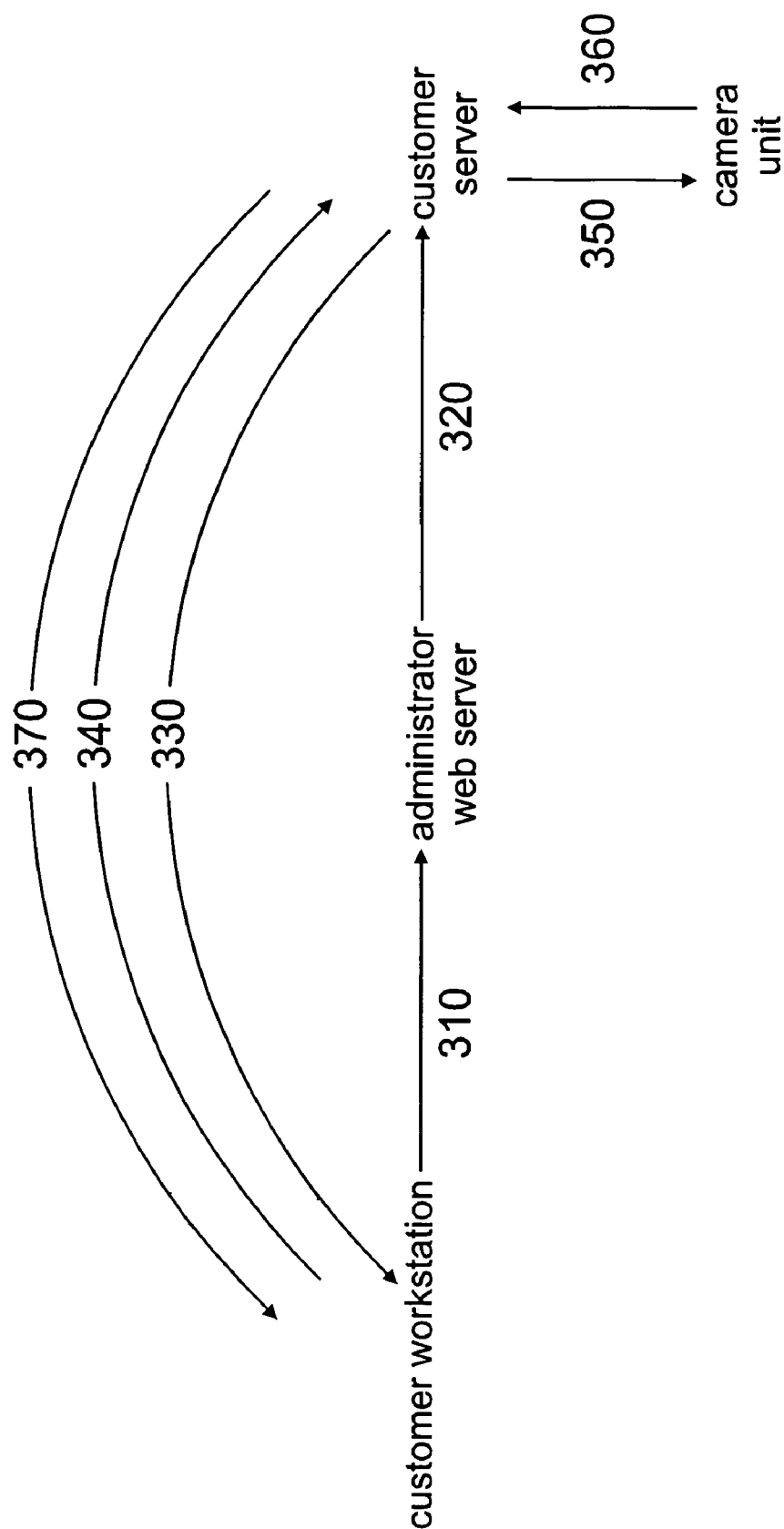


FIG. 3

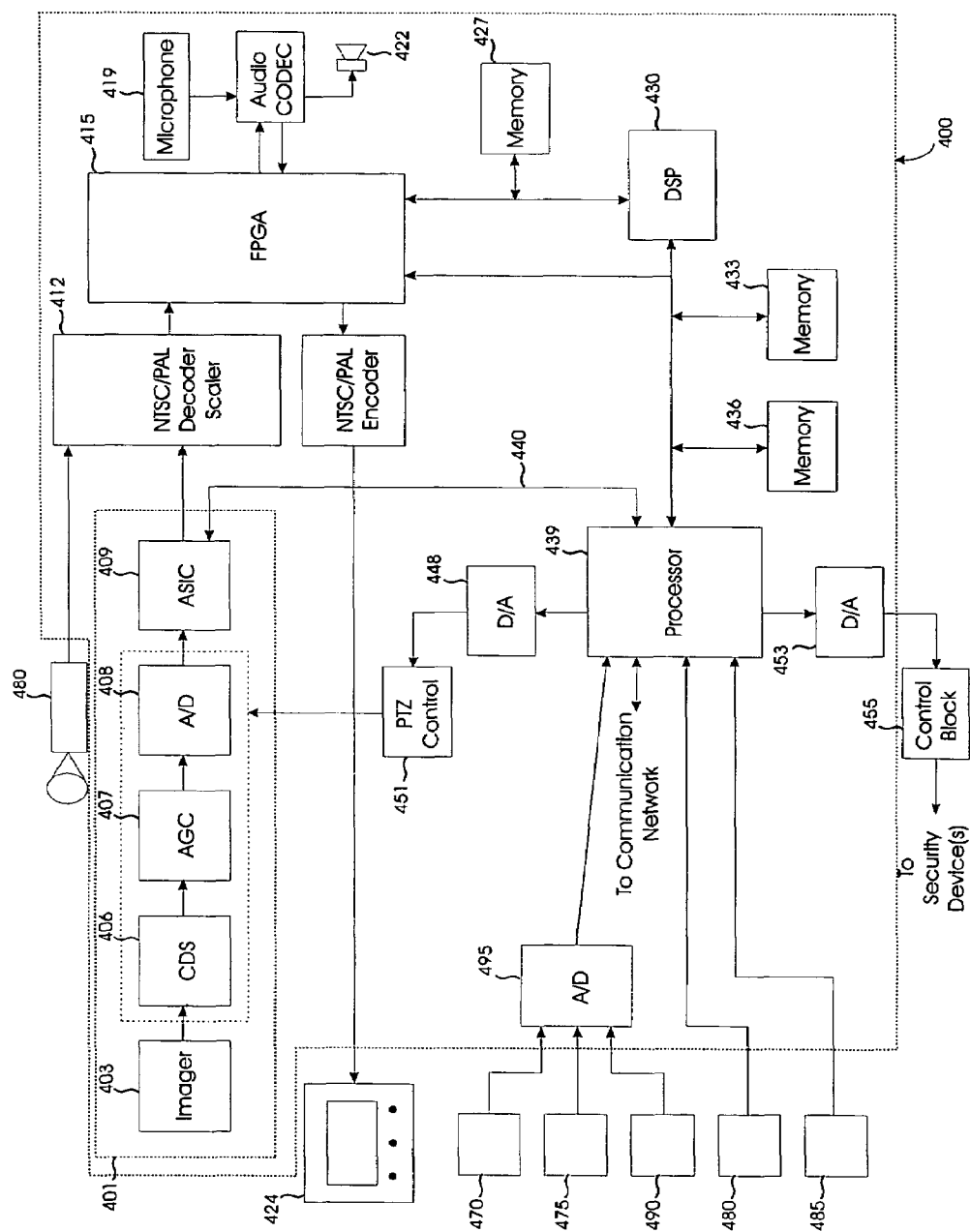


FIG. 4

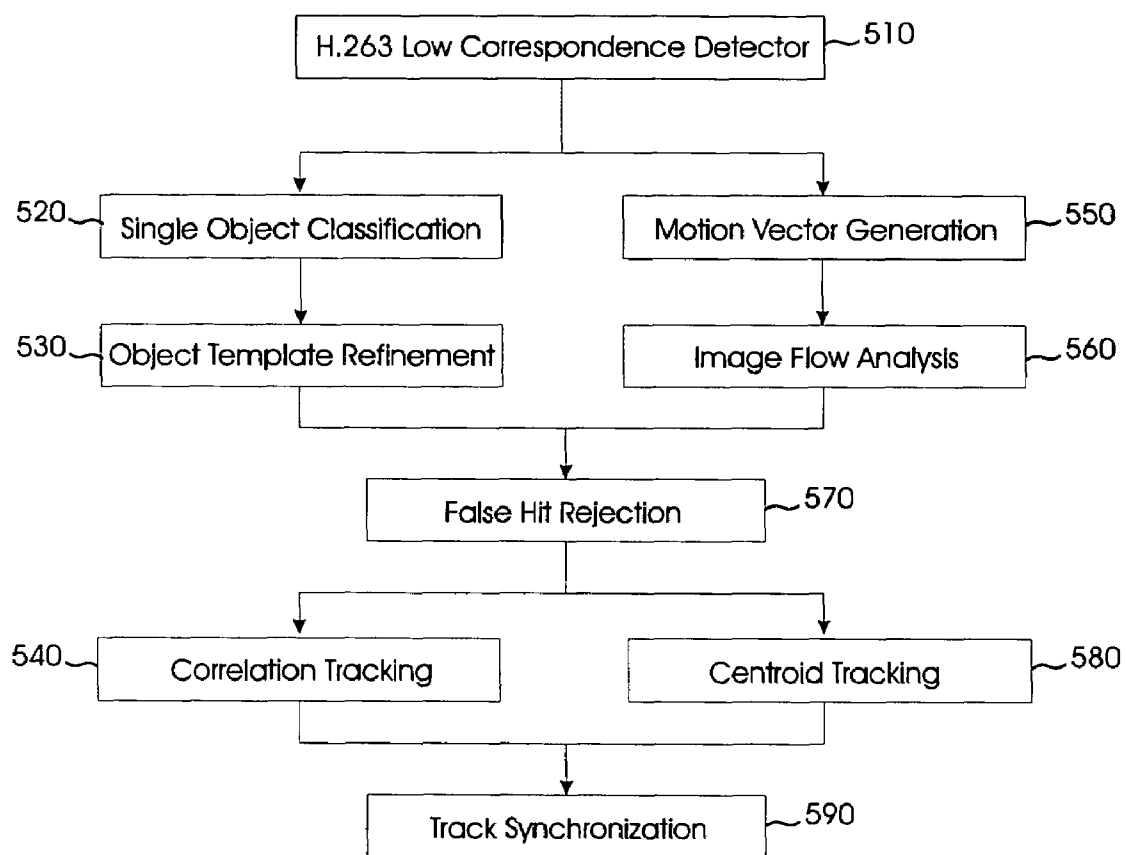


FIG. 5

U.S. Patent

Oct. 11, 2005

Sheet 6 of 13

US 6,954,859 B1

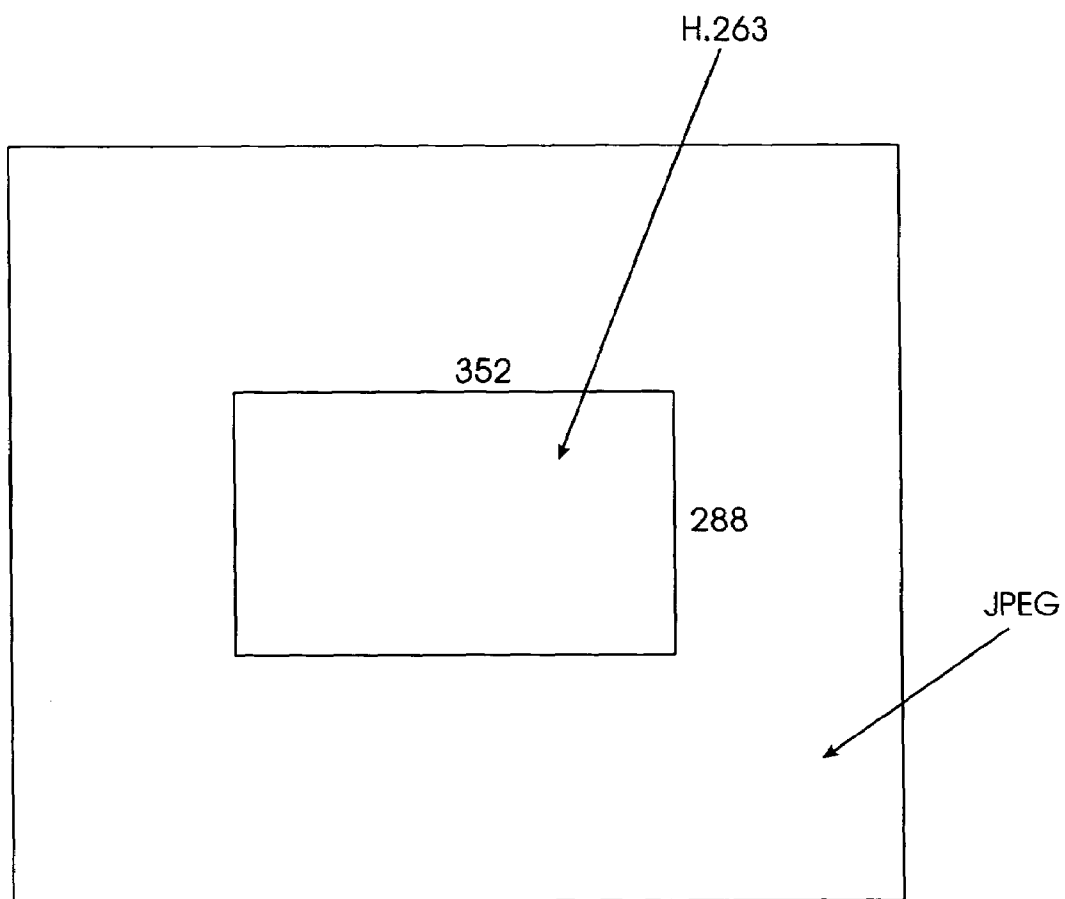


FIG. 6

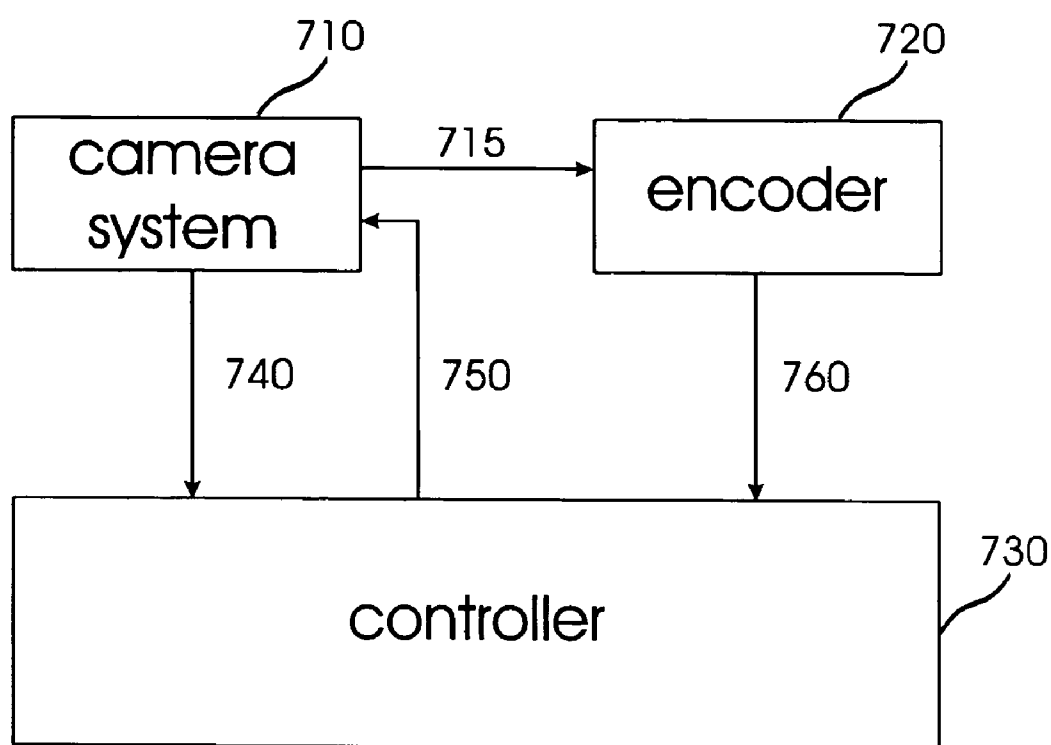


FIG. 7

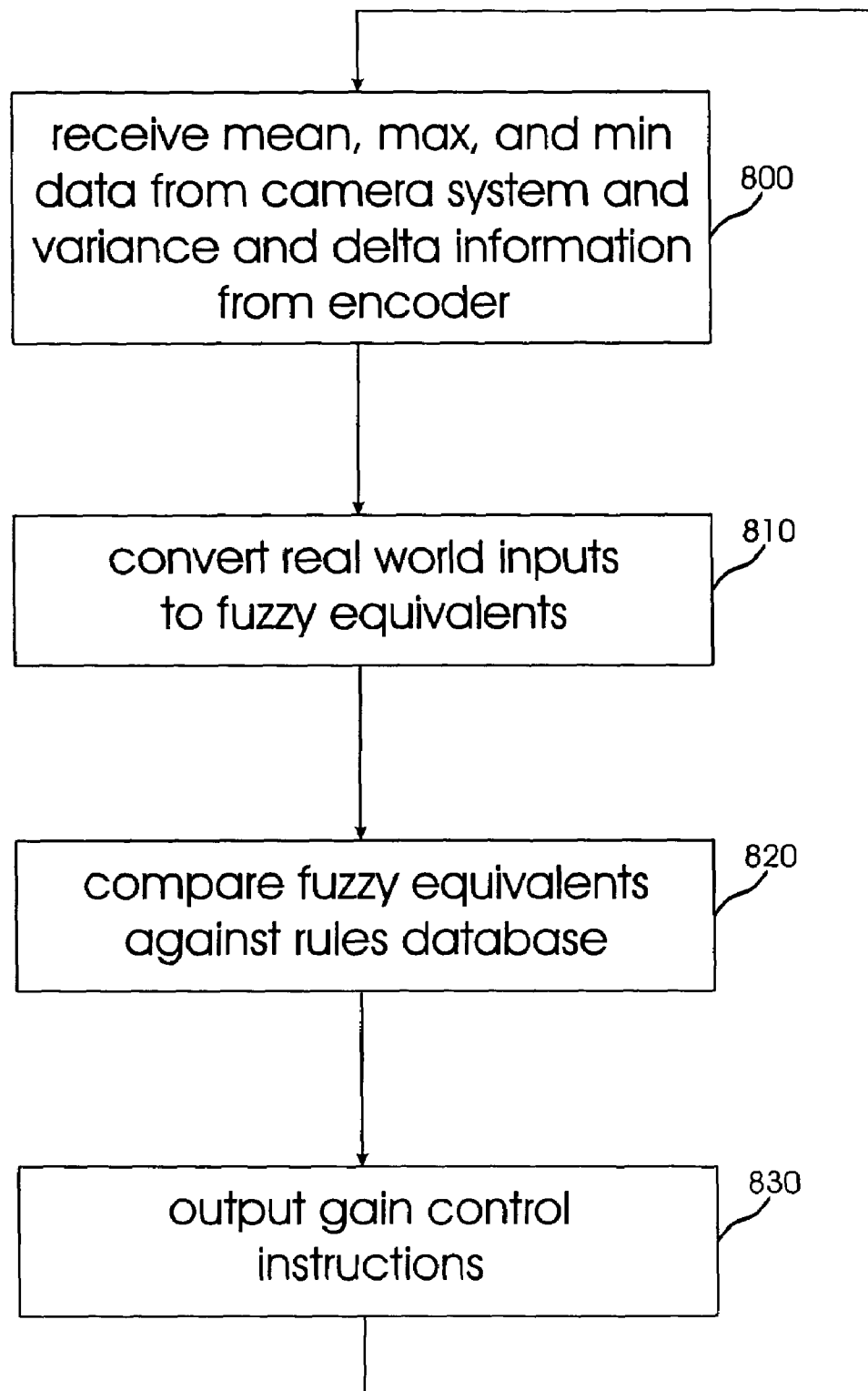


FIG. 8

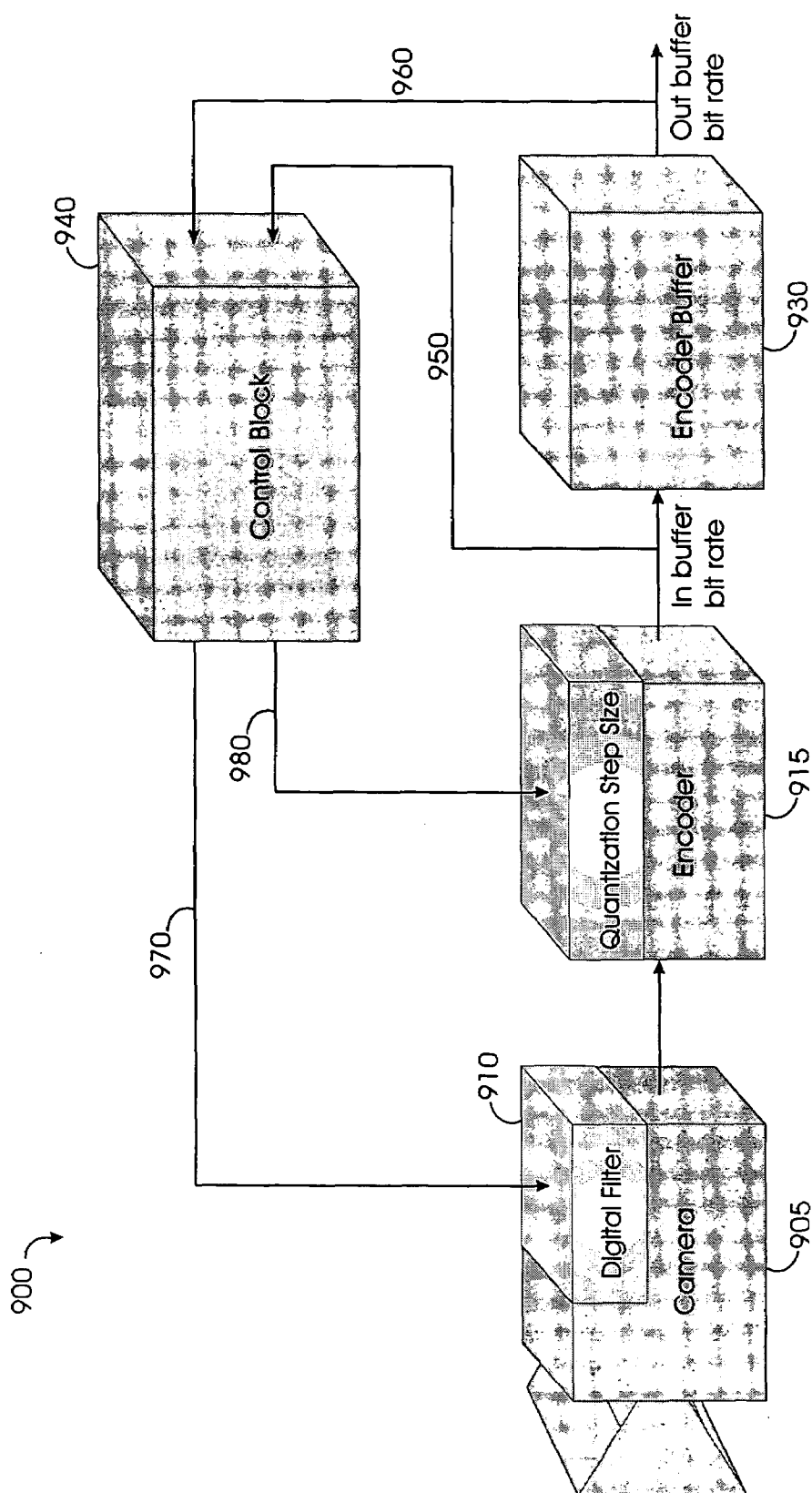


FIG. 9

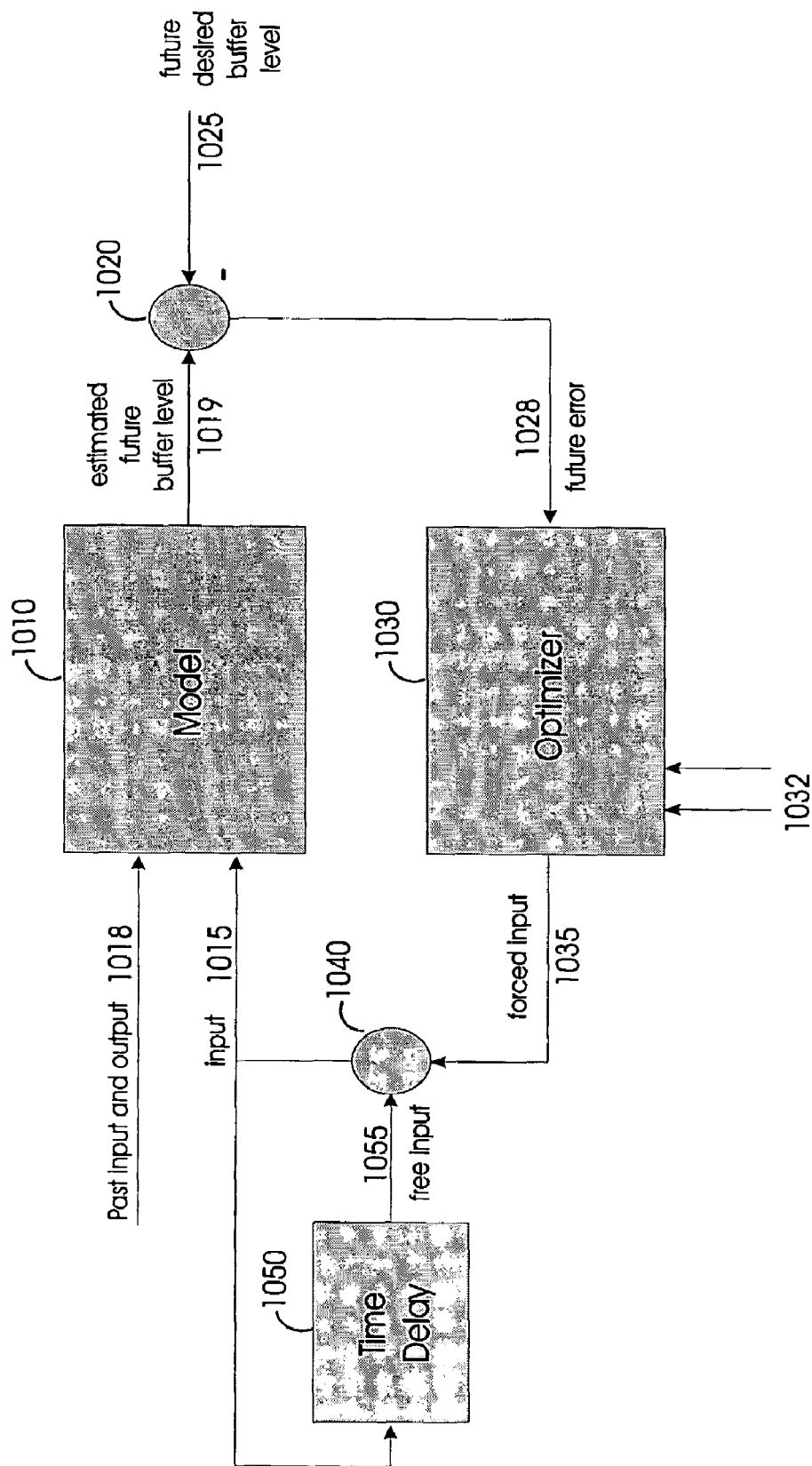


FIG. 10

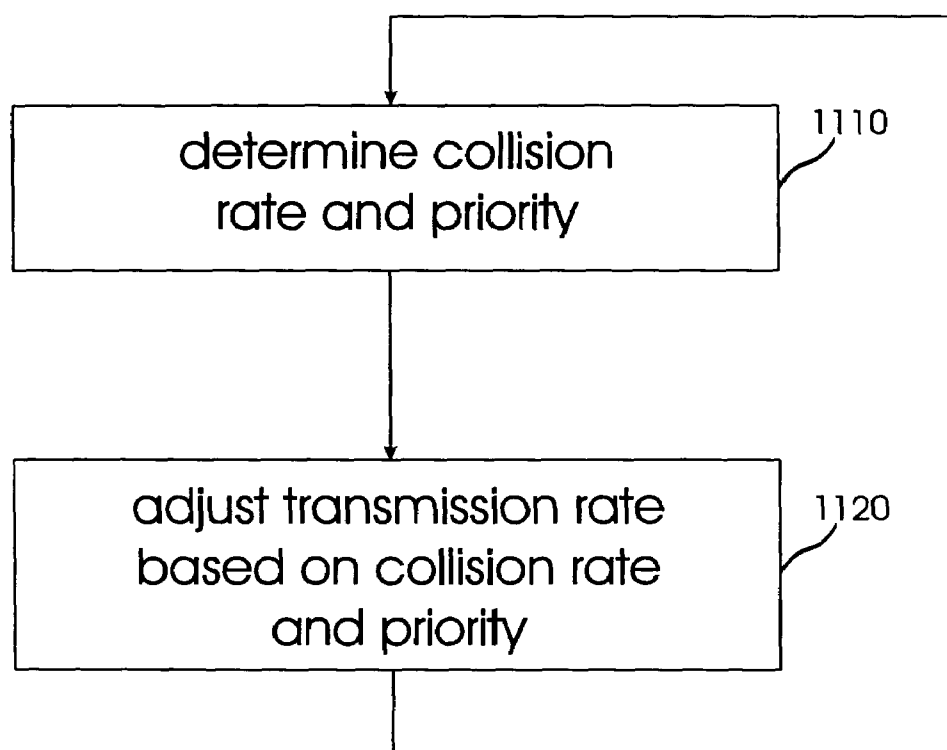


FIG. 11

U.S. Patent

Oct. 11, 2005

Sheet 12 of 13

US 6,954,859 B1

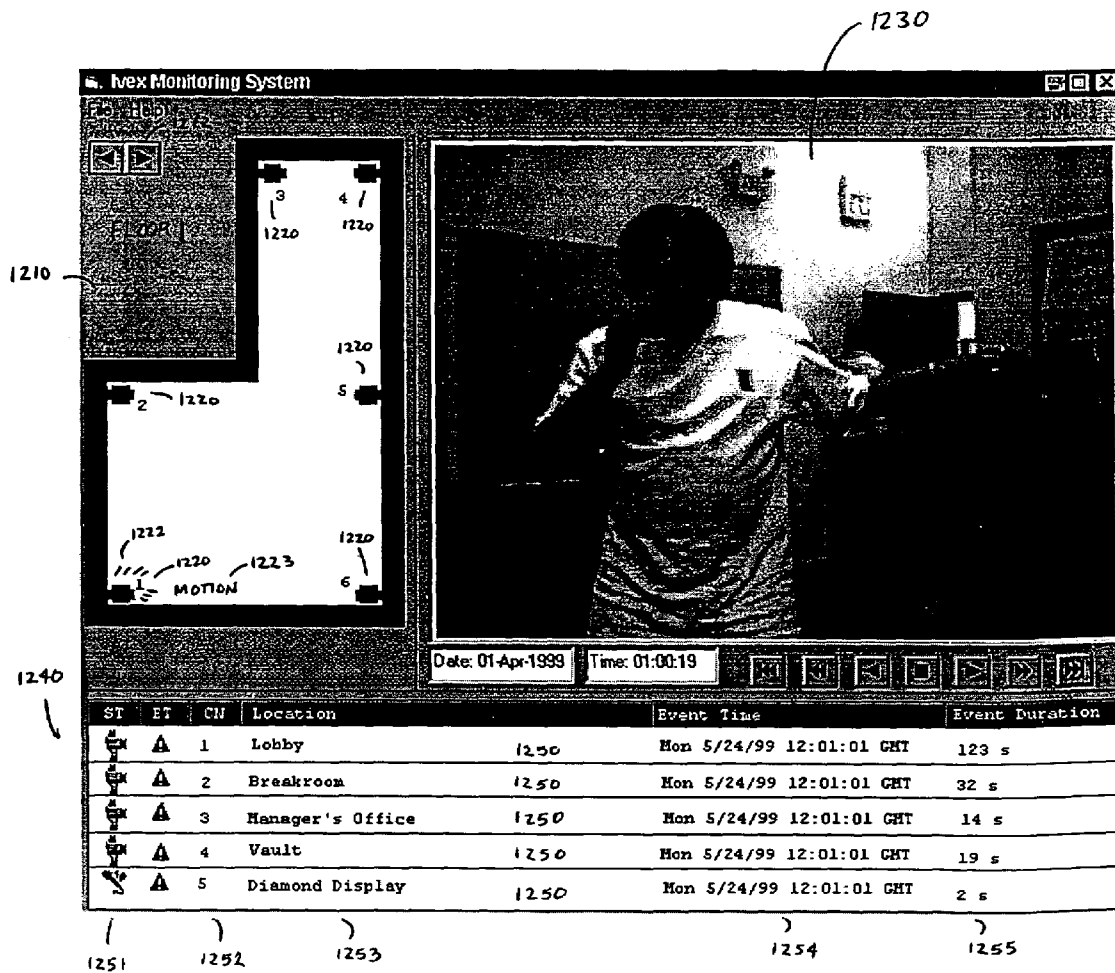


FIG. 12

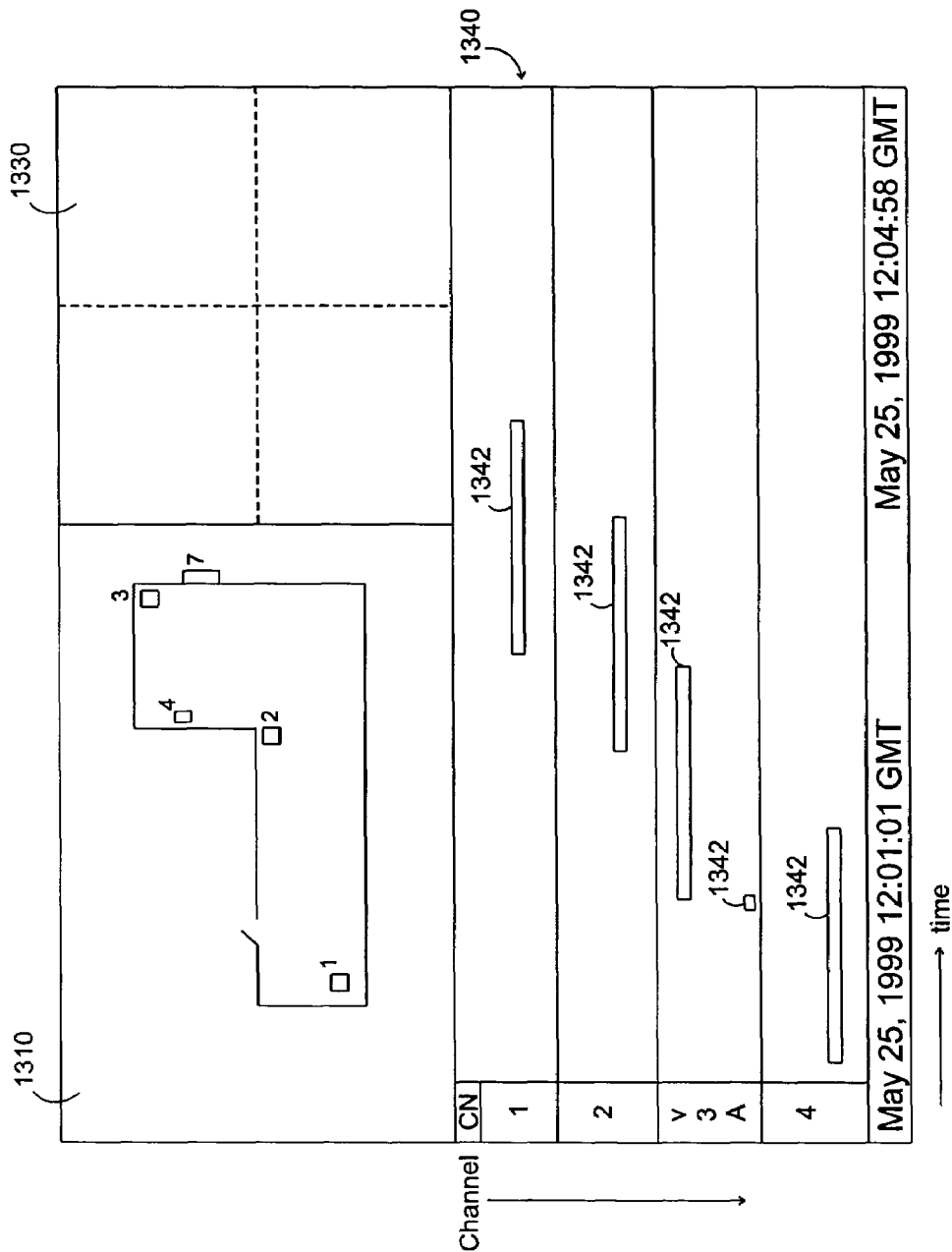


FIG. 13

US 6,954,859 B1

1

NETWORKED DIGITAL SECURITY SYSTEM AND METHODS

FIELD OF THE INVENTION

The present invention relates to networked digital security systems and methods.

BACKGROUND OF THE INVENTION

While digital security systems have been disclosed (see, e.g., U.S. Pat. No. 5,875,305 to Winter et. al, U.S. Pat. No. 5,625,410 to Washino, and U.S. Pat. No. 5,689,442 to Swanson), present digital security systems do not fully take advantage of the significant intelligence possibilities offered by digital cameras, programmable digital signal processors, and programmable communications processors. Nor do the present systems offer a fully integrated networked digital security system including a centralized web server that allows for authentication and access control to digital security services, remote configuration of intelligent camera units and customer servers, and significant administrative and billing functions via the Internet.

SUMMARY OF THE INVENTION

According to one embodiment, the present invention relates to a digital security system comprising: at least one camera unit for capturing and transmitting frames of video and/or audio signals over a communications network; at least one customer server coupled to the camera unit via the communications network; at least one customer work station coupled to the customer server via the communications network; an administrator server coupled to the at least one client server via the communications network; and authentication means at the administrator server for authenticating a customer at the at least one customer work station so as to allow the work station to receive the video and/or audio signals transmitted by the at least one camera unit.

In one mode, the camera unit preferably transmits video and/or audio signals over the communications network only after detecting a predefined event. The camera unit also preferably transmits video and/or audio signals over the communications network in response to receiving a command from a user at the customer work station or an administrator work station.

The camera unit preferably tags the frames of video and/or audio signals based upon detecting one of a plurality of predefined events, and also transmits an event packet upon detecting a predefined event. The camera unit preferably tags the frames of video and/or audio signals by inserting information in the header of the transmitted frames that identifies the predefined event. Similarly, the event packet preferably includes information in the header of the event packet that identifies the predefined event.

The camera unit is preferably programmable to transmit either a snap shot or an event clip upon detecting a predefined event. The camera units are also preferably programmable to simultaneously transmit both a snap shot and an event clip upon detecting a predefined event.

The camera unit is also preferably programmable to detect different predefined events based on the time of day. The camera units may operate in a plurality of modes, and may be remotely configured to operate in one of the plurality of modes via, e.g., a customer work station.

The camera unit also preferably includes a glass break detector, wherein the glass break detector preferably

2

includes: an audio input receiver means, a digital signal processor for computing spectrograms of incoming audio signals, and a means for comparing a predefined glass break spectrogram template against the spectrograms computed by the digital signal processor.

The camera unit also preferably includes a motion detector that analyzes the video signals captured by the camera unit, wherein the motion detector preferably comprises a digital signal processor that includes an automatic learn component that automatically updates a stored background image against which the digital signal processor performs motion analysis detection.

The camera unit preferably increases one or more of the bit rate, pixel coding depth, the image size, frame rate, and compression algorithm associated with the video signals in response to detecting motion in the video signals or other certain predefined events. The camera unit also preferably includes an object detector and an object speed detector, and is preferably capable of transmitting an appropriate event packet over the network based on the speed of the detected object. The camera unit also preferably includes an object movement detector that detects the direction of movement of a detected object, and preferably determines whether to transmit an event packet over the network based on what direction the detected object is moving.

The authentication means of the administrator server preferably includes means to compare inputted user identification information against a database of monitored sites to which the user may access.

The administrator server also preferably receives the event packets and associated video and/or audio information, and intelligently routes the packets and information to one or more administrator work stations. The administrator server also preferably includes means for receiving event packet information from the camera units, and means for transmitting relevant contact information to one or more administrator work stations.

The administrator server also preferably includes means for receiving the event packet information from a camera unit and means for automatically contacting one or more of the local police, local fire department, and customer contact.

The camera unit also preferably includes a camera system; an encoder coupled to the camera system that encodes the video signals transmitted by the camera system; and an automatic gain controller coupled to the camera system and the encoder, the automatic gain controller receiving mean, maximum, and minimum intensity video signal values from the camera system, and variance and delta values from the encoder, and providing in response a control signal that controls the gain of the camera system so that the camera unit transmits video signals with substantially constant image luminance for varying lighting conditions.

The camera unit also preferably includes the camera system; an encoder coupled to the camera system that encodes the video signals transmitted by the camera unit; an encoder buffer coupled to the encoder; and an encoder buffer controller coupled to the camera system and the encoder buffer, the encoder buffer controller receiving as inputs an in buffer bit rate input from the encoder, and an out buffer bit rate from the encoder buffer.

The camera unit also preferably includes a network bandwidth controller that adjusts the signal transmission delay of the camera unit as a function of a network collision rate and the priority of the camera unit. The camera unit preferably autonomously determines its priority based on the type of predefined event it is experiencing.

US 6,954,859 B1

3

The camera units are preferably coupled to conventional sensors, and are configured to receive an alarm signal from the conventional sensors, and to transmit appropriate event packets over the network in response to receiving the alarm signals from the conventional sensors. The camera units may, depending on the detected event, start transmitting video and/or audio signals in response to receiving alarm signals from conventional sensors. The camera units may also change a characteristic of transmitted video and/or audio signals in response to receiving alarm signals from the conventional sensors.

The camera units may perform boolean analysis of alarm signals sent by the various conventional sensors and events detected by the camera unit before transmitting an event packet over the network.

The camera unit is preferably configured to simultaneously transmit video signals in more than one compression algorithm standard format in response to detecting certain predefined events. For example, a camera unit may simultaneously transmit video signals according to the JPEG format and the H.263 format in response to detecting certain predefined events. The camera units are also preferably configured to simultaneously transmit video signals having differing bit rates, frame rates, image sizes, and pixel coding depths.

A graphical user interface is preferably provided at the administrator and/or customer workstations such that the graphical user interface schematically displays event durations for a plurality of camera units. The video or audio information schematically represented by the event duration display is preferably accessible by a user clicking on the event duration display.

The customer and administrator work stations preferably include a multi-algorithm reader that allows the work stations to display successive frames of video signals encoded in different compression algorithm standard formats.

These and many other features of the present invention will be better understood after reading the remainder of this application.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is an illustrative block diagram of the system of the present invention;

FIG. 2 is a schematic representation of the administrator web server;

FIG. 3 depicts the process by which the administrator web server controls access to customer servers and camera units;

FIG. 4 is a block diagram of the intelligent camera unit of the present invention;

FIG. 5 depicts the object recognition and tracking algorithms of the present invention;

FIG. 6 depicts different frames of video that may be simultaneously transmitted by the camera units of the present invention;

FIG. 7 is a block diagram of the intelligent gain controller of the present invention;

FIG. 8 is a flowchart that outlines the algorithm ran by the intelligent gain controller of FIG. 7;

FIG. 9 is a block diagram of the encoder buffer controller;

FIG. 10 depicts the preferred model predictive control algorithm for the encoder buffer controller;

FIG. 11 is a flowchart that outlines the algorithm ran by the network priority bandwidth controller;

FIG. 12 is an illustrative viewer user interface page; and

FIG. 13 is an illustrative "piano-roll" viewer interface page.

4

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

The networked digital security system of the present invention provides an intelligent security service to a plurality of customers at a plurality of monitored sites that are remote from a centralized administrator web server. As will be discussed in detail below, the centralized web server advantageously acts as a point of control for management of the monitored sites including: access and authentication control; configuration of customer servers and camera units at the monitored sites; handling of and storage of video, audio, and associated alarm event information transmitted by the camera units at the monitored sites; and several administrative and billing functions.

FIG. 1 shows a system diagram of the present invention. A centralized administrator web server **10** is coupled via a communication network such as the Internet **100** to a plurality of administrator work stations **20**, a plurality of customer servers **40** and a plurality of customer work stations **30**. The customer servers **40** are preferably located at the customer's monitored sites. Camera units **50** are preferably fully integrated intelligent units that gather, analyze, and transmit video, audio, and associated alarm event information to their associated customer server **40** and on to the administrator web server **10**. The information transmitted by the camera units is also accessible to an authorized user at a customer work station **30** and administrator employees at administrator work stations **20** via the servers. The camera units will be discussed in detail below. The customer work stations **30** may be coupled to customer servers **40** via a local area network, a global area network such as the Internet **100**, or some combination thereof as is illustrated in FIG. 1.

While only a couple of customer servers **40** and customer work stations **30** are shown in FIG. 1, it will be understood that the system is capable of servicing many more customer servers and customer work stations, which may be located throughout the United States and elsewhere. The customers may include any person or entity that subscribes to the security services offered by the administrator, and may include, e.g., individual residences, schools, stores, banks, museums, etc.

One or more administrator work stations **20** are also coupled to administrator server **10** via a local area network, a global area network such as the Internet **100**, or some combination thereof, as illustrated by administrator work stations **20a** and **20b**. There may be many more administrator work stations **20** than are shown in FIG. 1. The administrator work stations are utilized by administrator employees to monitor the customer sites, retrieve stored video, audio, and event information, and configure camera units **50** and customer servers **40**.

Administrator server **10** preferably is a programmed general purpose computer that includes (as schematically represented in FIG. 2) a processor **212**, memory **214**, and input/output means **280**.

Memory **14** stores customer information **216**; audio, video, and event information **218**; log entry information **220**; false alarm information **230**; monitored site layout information **250**; camera unit and customer server information **260**; and computer programs **260** that run the administrator server in accordance with the present invention.

The stored customer information **216** preferably includes for each customer: system identification number (user id); a password; information concerning the monitored sites that the customer may access from a customer work station; and

US 6,954,859 B1

5

information concerning the configuration options that the customer may access for each monitored site. The audio, video, and event database information **218** includes the stored audio, video, and event information that has been transmitted to the administrator server from the camera units **50**. False alarm information **230** includes information relating to false alarms. The monitored site layout information **250** preferably includes information relating to the layout of each monitored site, and the positioning of the camera units at each monitored site. This information is manually inputted by an administrator employee. Camera unit and customer server information **260** includes information relating to the camera units including the location of each camera unit and customer server and relevant contact information relating to each camera unit.

The input/output means **216** includes the web site of the present invention. As is well known, however, a separate web server may be utilized to host the web site of the present invention, with the database information stored in memory **14** contained in a database server coupled to the web server via a local area network, or any other communication network.

As mentioned above, the administrator web server **10**, among other things, advantageously controls customer access to the security services offered by the present invention by requiring a customer at a customer work station **30** to log into the administrator server **10** before he may: access any information transmitted by the camera units **50** associated with his monitored site(s); access information stored at customer servers **40** associated with his monitored site(s); or configure any customer servers **40** or camera units **50** associated with his monitored site(s). That is, no request for services is honored by a customer server **40** unless the session is originated by the administrator web server **10**. As such, the customer servers are not directly accessible from any customer work station.

This authentication and control process is schematically illustrated in FIG. 3. At step **310**, a customer at a customer work station attempts to log into the administrator web server by preferably entering previously issued user identification and password information. (Of course, any log-in procedure that authenticates a user may be used.) If the inputted user identification and password are accepted by the administrator server, the administrator server **10** then provides access on the customer work station **30** only to those monitored sites that are associated with the inputted user identification in customer database **216** in the administrator server **10**. In addition, whether the customer will have access to any of the available customer server **40** and camera unit **50** configuration options via an user interface at the customer work station **30** is also determined and controlled by the administrator server **10** at this time by comparing the inputted user identification with the customer database information **216**.

If the customer selects via the user interface at customer work station **30** a monitored site associated with a particular customer server, the administrator web server starts a session between the customer work station and the particular customer server (steps **320** and **330**). Once the session is initiated, the customer server opens up channels to the customer work station: one or more channels for commands and events, and channels for audio and video information. Once the session is established, the customer work station may communicate directly with the customer server, e.g., by instructing (step **340**) the customer server to display (steps **350–370**) live video from a particular camera unit.

6

The customer servers **40** capture the information transmitted by their associated camera units **50**, store information transmitted by the camera units, and service retrieval requests for video and audio information and event data. The customer servers are also capable of controlling the configuration of their associated camera units **50** under the control of an authorized customer at a customer work station **30**. For example, the customer servers **40** may remotely and individually configure each camera unit **50** to detect one or more alarm events. The alarm events that may be detected by the internal circuitry of camera units **50** at least include: 1) no event; 2) glass break, scream, and gunshot detection; 3) detection of motion and rapid changes in motion; 4) the opening or closing of a door or window; 5) detection of rapid, dramatic changes in ambient light levels; and 6) other video and audio content changes or characteristics. Camera units **50** may also be coupled to any number of conventional sensors such as contact sensors for doors and windows, motion detectors, glass break detectors, panic buttons, temperature sensors, smoke sensors, etc. Whether the camera units will transmit alarm events based on receiving alarm signals from these conventional sensors may be remotely and individually configured via the customer servers.

Under the control of an authorized customer at a customer work station **30**, the customer servers can also control the alarm state of each of its associated camera units **50**. The states include alarm off (e.g., during business hours), and alarm on (e.g., after business hours). The customer servers **40** may also configure the operation mode of each of their associated camera units **50**. The operation modes include: 1) quiet mode; 2) live viewing mode; and 3) event detection mode.

In the quiet mode, preferably the default state of the camera units **50**, a specified camera unit buffer continually receives video and/or audio information and stores it to a rolling buffer. It does not, however, transmit the information to the customer and administrator servers.

In the live viewing mode, a specified camera unit transmits video and/or audio information over the network to its customer server. The customer server then provides the video and/or audio information to either a customer work station or an administrator work station when prompted to do so by a user at one of the work stations. The camera unit continues to transmit the information until the user transmits an instruction to stop. The live viewing mode can be used at any time regardless of the alarm state (alarm on/off) or whether an event is occurring. Moreover, there should be relatively little delay in displaying the information on the work station because the video transmitted to the network is a pass-through of the video information, rather than a slightly delayed post-buffer transmission. The live viewing mode allows store owners, managers, etc. to view their monitored sites at anytime.

In event detection mode, a camera unit transmits video and/or audio information to its associated customer server and to the administrator web server when it detects the occurrence of an event.

It is important to recognize that the camera unit operation modes are independent of the alarm state (alarm on/off). Any camera unit can be in any of the operation modes regardless of whether the alarm state is on or off. In addition, live viewing mode and event detection mode can be active simultaneously for a given camera unit. That is, the camera units are capable of handling and transmitting an event while in the live viewing mode.

The type of transmission that a camera unit provides over the network upon detecting predefined events may also be

US 6,954,859 B1

7

individually, remotely configured. For example, for certain predefined events, a camera unit **50** may be individually, remotely configured by a customer work station **30** to transmit a relatively high resolution picture (e.g., by increasing the pixel coding depth for the frame) over the network, a snap shot. The camera unit may also increase the pixel coding depth. For other predefined events, a camera unit may be individually, remotely configured to transmit a length of video and/or audio bounded by the duration of the event, an event clip. As will be seen below, a camera unit **50** may also be individually, remotely configured to simultaneously transmit both a snap shot and an event clip upon detecting certain predefined events.

As will be discussed in more detail below, the camera units may also be individually, remotely configured to detect different events based on the time of day. That is, the camera units may be programmed such that certain detected activity triggers an alarm event only during programmed periods of time during the day. Moreover, the camera units **50** may be individually, remotely configured to have different event detection mode settings for different alarm states. For example, a camera unit **50** can be configured for snap shots during alarm on times and event clip during alarm off times. Illustratively, a lobby camera unit **50** could be configured to transmit only a snap shot of every person entering the building during the day (alarm off), while configured to transmit event clips during the night (alarm on) so as to capture the actions of an intruder for the duration that he is in the camera unit's field of view.

When a camera unit **50** is configured for snapshot and an event occurs, the camera unit will transmit event data describing the event (preferably coded header information that describes the event) and one or more tagged images to its associated customer server and to the administrator server. The servers then translate the event data into SQL commands for storage. These images are preferably relatively high resolution JPEG images. The number of images transmitted per event is also individually, remotely configurable.

When a camera unit **50** is configured for event clip and an event occurs, the camera unit will transmit to the customer and administrator servers: event data, tagged buffered video and/or audio information captured up to the event detection, and tagged live video from event detection until the event ends. The length of buffered video and/or audio sent as part of the event video clip is individually, remotely configurable. This setting option may, however, be limited by the amount of memory in the camera unit. The presently preferred embodiment allows the camera unit to buffer **80** seconds of video at 384 kbps (CIF resolution, 15 frames per second) prior to an event, by providing 4M of DRAM. This memory is of course expandable.

Under the control of an authorized customer at a customer work station **30**, a customer server may also configure the frame rate, the bit rate, pixel coding depth, and the size (for video) of the video and/or audio information transmitted by its associated camera units, as well as the compression algorithms used by its associated camera units. Moreover, the parameters for adjusting any of the bit rate, pixel coding depth, frame rate, size, and compression algorithm used by the camera units upon detecting predefined events are also individually, remotely configurable. For example, the parameters for adjusting the frame rate upon detecting rapid, dramatic changes in ambient light level are configurable via the customer server.

Finally, an authorized customer can specify the time frame used to display event lists in the view function on the

8

user interface to be described below in connection with FIG. **12**. For example, the user may specify that all events less than N minutes or hours old will be displayed on the event list.

The customer servers **40** also include memory. The memory allows video and audio information transmitted by associated camera units to be saved to a hard drive at the customer servers. This information is preferably accessible on-line. The video is preferably recorded at 384 Kbps. The video and/or audio that is recorded varies depending on the mode a particular camera unit is in and how the camera unit has been configured. The customer server **40** is capable of recording at variable bit rates as configured by an authorized customer at a customer work station. The presently contemplated preferred variable bit range is 20 Kbps–10 Mbps. An authorized customer at a customer work station **30** can also transmit instructions to a customer server **40** to start or stop recording.

The customer server **40** also includes memory for archival purposes. This allows the audio and video data to be saved to media such as DVD RAM or DAT tape for long term storage. This data is preferably not available on-line. If an event occurs while video is being archived, the customer server will stop archiving. Once the event ends, it will automatically continue the archiving at the point where it stopped. A customer at a customer work station may also configure the system to automatically archive video and audio information. Moreover, whether such video and audio information is automatically archived can be configured by the customer based on the different camera unit and alarm state settings described above.

A record capability may also be provided at customer work stations **30**. If it is provided, the customer can select via a user interface: 1) what (if anything) will be recorded at the customer work station; 2) when it will record (e.g., day and time, independent of camera unit mode or event state); 3) how long it will record; and 4) the quality level (e.g., bit rate or frame rate). The customer may specify different recording configurations for each of the two alarm states (alarm on and alarm off), and also has the option of initiating recording manually via the user interface.

An archiving capability may also be provided at customer work stations **30**. If it is provided, the customer can select via a user interface: 1) what (if anything) will be archived at the customer work station; 2) when it will be archived (e.g., day and time, independent of camera unit mode or event state); 3) how long it will be stored; and 4) the quality level (e.g., bit rate or frame rate). The customer may specify different archiving configurations for each of the two alarm states (alarm on and alarm off), and also has the option of initiating archiving manually.

In addition to the authentication and access control function described above, the centralized administrator web server **10** also allows for the configuration of customer servers **40** and camera units **50** via administrator work stations **20**; handles, routes, and stores the video, audio, and associated alarm event information transmitted by the camera units at the monitored sites; and provides several administrative and billing functions.

The camera units **50** can be configured via the administrator work stations **20** in the same fashion as described above in connection with customer work station control of the configuration of the camera units. The recording and archival features of the customer servers **40** can also be configured via the administrator web server in a manner similar to that described above in connection with the customer servers. The site floor plans for the site(s) associ-

US 6,954,859 B1

9

ated with each particular customer server may also be configured and updated as necessary via the administrator work stations. The rate at which video is transmitted from a customer server to a given customer work station is also configurable. General system diagnostics, and other customer server updates may also be performed remotely via the administrator web server.

The administrator server **10** also receives the audio, video, and event information transmitted by the camera units, preferably stores the information for both on-line and off-line storage in a manner similar to that described in connection with the customer servers, and intelligently routes the information received from the camera units to specific administrator work stations **20** so that the sites may be monitored by administrator employees.

The administrator server **10** also preferably includes a computer program that matches event data received from a particular camera unit **50** to relevant telephone numbers (or other contact information such as but not limited to pager numbers, e-mail addresses, and other contact information) related to that camera unit's monitored site that is preferably stored in camera unit database **260**. The matching process may also depend on which predefined event is received by the administrator server from a particular camera unit. For example, upon receiving a glass break event from a particular camera, the administrator server may be programmed to place phone calls and play a prerecorded message to one or more of the local police, the local fire department, the local ambulance service, or the designated customer contact(s). On the other hand, upon receiving an event relating to a dramatic change in light for a particular camera unit, the administrator server may or may not place any phone calls or make in any contacts via the contact information discussed above. A customized matching process may be provided for each customer site, or even each camera unit.

Alternatively, the administrator may include a computer program that matches event data sent from a particular camera unit to relevant telephone numbers relating to that camera unit's site but does not automatically make any phone calls or otherwise try to contact the relevant entities described above. In this case, when event data is received by the administrator server from a particular camera unit, the administrator server causes relevant telephone number or other contact information to be displayed on one or more specified administrator work stations **20**. The relevant contact information may include contact information for the local police, local fire department, ambulance service, and the customer. The administrator employee could then analyze the event, including reviewing any relevant video and/or audio information, and make the decision as to who should be contacted.

The administrator server **10** also provides administrative and billing functions. Specifically, it preferably maintains false alarm information **230** that maintains for each camera unit: where the camera unit is located; the types of alarm events transmitted by the camera unit and when they were transmitted; and whether the alarm events were false alarms. Information regarding false alarms for each of the camera units may be entered into false alarm database information **230** of the administrator server **10** by an administrator employee.

The computer processor **212** operating under the control of computer programs **270** of the administrator server **10** periodically computes the percentage of false alarms for each monitored site, each camera unit, and each event type for each camera unit and stores this information in the false alarm information database **230**. This information is avail-

10

able via an user interface to administrator employees at administrator work stations **20**. In this way, an administrator employee may view the false alarm information, analyze any associated video and/or audio information, and determine whether any of the camera units need to be re-programmed in a way to reduce false alarms. For example, a particular camera unit may have transmitted several false alarms for motion detection that only related to a tree blowing in the background. The administrator employee may view the false alarm information, analyze the associated video information, and remotely configure the camera unit to either change a region of interest for motion detection and/or increase the amount of motion that must be detected by the camera unit before it transmits a motion detection alarm event.

The alarm information computed by the administrator server may also be used to provide a variable rate billing service based on the number of alarms and the number of false alarms.

The customer servers **40** and administrator server **10** also maintain log entry storage information **220** regarding which customer and administrator work stations are viewing specific video and audio information over the system, and for how long. This information may also be used for billing purposes.

The camera units will now be described in connection with FIG. 4. As is shown, each camera unit **400** advantageously includes a digital camera system **401**, decoder/scaler **412**, FPGA **415**, audio CODEC block **418**, microphone **419**, audio speaker **422**, a digital signal processor (DSP) **430**, a processor **439**, storage means **427**, **433**, and **436**, digital-to-analog converter **448**, pan/tilt/zoom control **451**, digital-to-analog converter **453**, and analog-to-digital converter **495**. FIG. 4 also shows a conventional analog camera **480**, display **424**, control block **455**, and conventional alarm glass break sensor **470**, convention alarm motion detection sensor **475**, conventional alarm contact sensor **480**, conventional alarm panic button sensor **485**, and other conventional alarm sensors **490** such as heat detectors and smoke detectors.

The digital camera system **401** preferably includes a CCD or CMOS imager **403** which converts photons to voltage so to provide an analog video signal to a correlated double sampler **406**. As is well known, the correlated double sampler (CDS) samples the incoming analog video signals twice for each pixel duration so as to remove noise. The CDS then transmits the sampled video signals to an automatic gain controller **407**. The video signal is then transmitted to an analog-to-digital converter (A/D) **408** that converts each sample of the video signal into digital pixel data that is preferably 10 bits long. (The dashed lines surrounding CDS block **406**, AGC block **407**, and A/D converter **408** indicate that these blocks are preferably provided by one chip.) The digital pixel data is then received by an ASIC **409** that converts the pixel data into a standards compliant video stream, preferably the CCIR601 standard. A CCIR601 video stream includes a 8 bit luminance signal word Y, and two 8 bit chrominance signal words (Cr and Cb).

Block **412** depicts a NTSC/PAL decoder and a scaler. The NTSC/PAL decoder converts NTSC/PAL analog data received from the optional external analog camera **480** into the preferred CCIR601 standard compliant video stream. The scaler may adjust the image size of the video stream output by ASIC **409**.

Field programmable gate array (FPGA) **415** includes a video signal operation component and an audio signal operation component. The video signal component of FPGA

US 6,954,859 B1

11

415 demultiplexes the 8 bit video input into separate 32 bit YUV data for use by the encoders in DSP block 430. The video component also multiplexes 32 bit YUV data from the decoders in DSP block 430 into 8 bit video output for display on external monitor 424.

The audio signal component of FPGA 415 multiplexes and demultiplexes serial audio data (preferably complying with the AC97 standard) from the audio CODEC block 418, and sends pulse code modulated audio data to the DSP block 430. It also sends commands to processor 439 regarding volume, sample rate, and other control signals relating to the audio signals. The audio CODEC block 418 digitizes analog data received from microphone 419 into serial data streams and provides the streams to FPGA 415; it also converts digital audio signals to analog audio signals for transmission to speaker 422.

The DPS block 430, among other things, provides several compression/decompression algorithms for video (e.g., H.263, JPEG, Wavelets, MPEG-1, MPEG-2, MPEG-4, MPEG-7, etc.) and audio (G.711, G.723, G.729, etc.) so as to compress and decompress video and audio information transmitted to and received from processor 439. Processor 439 is the main processor for each camera unit. It makes decisions, interacts with the customer server, and provides for master timing control of the video and audio information processed by the camera units. This control includes controlling pan/tilt/zoom (PTZ) functions of the camera system 401 via D/A block 448 and PTZ control block 451. Storage means 436 stores the computer programs of the present invention that are accessed by the processor 439 and DSP block 430, while storage means 427 and 433, respectively, provide working DRAM memory for the DSP block and processor 439.

As discussed above, the camera units 400 capture video and audio information, analyze the information, and transmit event data based on the analysis of the video and audio information. Specifically, the internal circuitry in the camera units allow the units to at least detect the following events: 1) no event; 2) motion detection and rapid changes in motion; 3) glass breaking, scream, and gunshot; 4) the opening or closing of a door or window; 5) dramatic changes in light levels; and 6) other video and audio content characteristics and changes. Advantageously, the camera units are capable of detecting and transmitting multiple, distinct alarm events simultaneously. The camera units may also be coupled to the conventional sensors described above so as to receive alarm signals from the sensors and detect alarm events associated with the conventional sensors as well. When any of these events are detected, the camera units send an appropriate event packet (preferably coded header information describing the event) to the customer and administrator servers on a channel separate from the audio and video information channels, and send tagged snap shot and/or tagged event clip information to the customer and administrator servers on audio and video channels. In addition, an audio alarm may be generated at the camera unit based on the detection of certain pre-defined events.

Also as discussed above, the camera units 400 are individually, remotely configurable via the customer work stations 30 and the administrator work stations 20 to detect one or more of the above events, and to change various characteristics of the transmitted audio and video information based on detecting the events. That is, based on the type of event detected, the camera units can autonomously change one or more of the following variables: the bit rate, pixel coding depth (i.e., the number of bits utilized to code a pixel), frame rate, image size (video only), and compression

12

algorithm. Based on certain predefined events, processor 439 of the camera units may also automatically control a pan/tilt/zoom (PTZ) control of the camera unit via D/A block 448 and PTZ control block 451. The event detection analysis in the camera units will now be described.

The DSP block 430 performs motion detection analysis by computing and analyzing the motion vectors associated with successive frames of video signals. The DSP may perform the motion detection analysis for specific predefined regions of interest within a particular camera unit's field of view as determined by software running on processor 439 for that particular camera unit; alternatively, the region(s) of interest may be a command from a user at either of a customer work station or an administrator work station. Each camera unit is capable of simultaneously analyzing several different regions of interest, which may be irregularly shaped and overlapping with other regions of interest.

If a predetermined threshold of movement is determined by the DSP 430 within a specified region of interest, it sends an interrupt signal to the processor 439. The processor 439 then sends an event packet describing the event to its associated customer server and the administrator server.

If motion has been detected, processor 439 also preferably increases the frame rate of the incoming video signal. The frame rate is controlled by changing the pixel clock and frame rate integration clock received as inputs at imager 403. This will provide for higher quality video. The bit rate, pixel coding depth, image size, and compression algorithm may also be automatically changed by processor 439 of the camera units based on a motion detection event.

The camera units advantageously implement an auto-learn component that allows each camera to sense its environment and self-calibrate a background image against which it preferably performs its motion detection analysis. The auto-learn component operates as follows. When a camera unit is first installed, a background scene is collected by the camera unit and stored in storage block 427. Based on the application and environment of the camera unit, the camera unit senses movement in the scene during a pre-defined time interval and references it to the stored background. If the change in the scene is constant for a predetermined amount of time (e.g., leaves blowing in a tree, a flag flying on a flag pole, or a new object that has been brought into the camera's field of view), a new background scene will be stored in storage block 427. These objects and motion fields will then be ignored by the camera unit when it is performing its motion detection analysis. This results in less false alarms. Moreover, because of the auto-learn feature, the camera units may be installed for operation at the site without any involved manual calibration procedure.

The DSP block 430 also calculates the frequency content of each frame, and transmits this data to processor 439. Based on the frequency content data, the desired frame rate, and the available bandwidth over the network, processor 439 adjusts the input filtering of the incoming video by writing to registers in ASIC 409 to adjust the input video frequency to the encoder of DSP 430 to better match the desired bit rate. Adjusting the input video frequency smooths out the sharp edges in a particular image frame, and therefore reduces the bit rate.

The DSP block 430 also calculates the bit rate during the encoding process, and transmits this data to processor 439. Based on movement detected within a frame or region of interest and the size of a proposed target, the image size, bit rate, and pixel coding depth are preferably increased. The bit rate command is transmitted to the DSP 430, and the image size command is transmitted to the scaler in block 412 and

US 6,954,859 B1

13

the DSP 430, and the pixel coding depth command is transmitted to A/D 408 via ASIC 409 or via a direct coupling between processor 439 and A/D 408.

The camera unit also detects dramatic changes in ambient light (e.g., lights being turned on, or the camera unit being spray painted or covered.) A histogram accumulator associated with the camera system 401 accumulates on a frame by frame basis the maximum, minimum, and mean intensity levels of the video signals, and transmits this information to processor 439. If these levels increase or decrease dramatically, processor 439 sends an event packet to its associated customer server and the administrator web server. Control of the camera unit based on detecting changes in ambient light is discussed below in connection with the intelligent gain controller.

The camera units 400 also capture and analyze audio information for potential event information. Specifically, the camera units include glass break, gunshot, and scream detectors that are implemented in software. Audio signals are first captured by microphone 419 and digitized by block 418. The digital audio signals are then transmitted by the FPGA into DSP block storage means 427. Next, the DSP block 430 constructs a normalized spectrogram for the digital audio signals. Processor 439 then compares the normalized spectrogram against predetermined normalized spectrogram templates for the breaking of different types of glass and other window materials, typical gunshots, and screams. If sufficient correlation is detected between the frequency and amplitude of the normalized spectrogram and any of the predetermined normalized templates, the processor sends out the appropriate event information packet to its customer server and the administrator server. In addition, the camera units may be individually, remotely configured to start transmitting video and/or audio information based on detecting any of these audio events and/or autonomously change the above described characteristics of the transmitted video and audio.

As discussed above, the camera units may also be coupled to conventional detectors such as glass break sensors 470, motion detector sensors 475, door or window closure contact sensors 480, panic button sensors 485, and other conventional sensors 490 such as heat detectors and smoke detectors. Processor 439 is preferably coupled to one or more conventional glass break sensors 470, one or more motion detector sensors 475, and one or more heat or smoke detector sensors 490 via an analog-to-digital converter 495 since such sensors generally provide voltage signals as a function of the detected signal. Processor 439 may be directly coupled to door/window contact sensors and panic button sensors since such sensors generally are switch-based sensors that provide signals that are easily detected by processor 439. Processor 439 is thus capable of detecting signals sent by these conventional sensors, and in response, transmitting appropriate event information to its associated customer server and the administrator server. In addition, the camera units 400 may be individually, remotely programmed to automatically start transmitting video and audio information upon receipt of one or more of the conventional sensor alarms and/or autonomously change the above described characteristics of the transmitted audio and video signals.

The camera units 400 may also be individually, remotely programmed to perform boolean analysis of the signals received from the conventional sensors and the alarm events that the internal circuitry of the camera units are capable of detecting. For example, processor 439 of the camera units may be programmed to output event packet information only

14

if motion is detected a predetermined time following or preceding receipt of an alarm signal from a conventional door/window contact sensor. Boolean analysis may be performed on any of the conventional sensor information received by the camera units and any of the event information internally detected by the camera units.

The camera units may also be individually, remotely configured to send signals to other security related devices responsive to detecting certain predefined events. As is shown in FIG. 4, processor 439 is preferably coupled to a digital-to-analog converter 453 in order to control circuitry associated with other security devices upon detecting certain predefined events. For example, responsive to detecting motion or the breaking of glass during non-working hours, the camera unit may send a control signal to a security device controlling a door. The security device responds to the camera unit's signal by locking the door, or disengaging key card or similar electronic access. In this way, even if an intruder has managed to enter one room of a monitored site, he may not easily enter another room. Responsive to other predefined events, the camera unit may send signals to make access easier. For example, if the camera unit detects a signal from a conventional heat sensor, it may send a signal to a control block controlling an exit door so as to automatically open the exit door. A camera unit may also be programmed to automatically open doors, gates, etc. upon detecting other predefined events. While only one control block 455 is shown in FIG. 4, it is understood that a camera unit may control several security related devices responsive to detecting predefined events.

The camera units are also individually, remotely programmable to open up a two way voice channel between the camera unit and a user at a customer and/or administrator work station responsive to detecting certain predefined events. The incoming audio is received by processor 439 and outputted on speaker 422 of FIG. 4, and the audio from the camera unit is received via microphone 419 and transmitted by processor 439.

The camera units 400 also implement object recognition and tracking algorithms running on processor 439. These algorithms are depicted by the flowchart of FIG. 5. The object recognition algorithm generates a coarse object template by monitoring the encoder of DSP block 430. The areas of the image that display little correspondence between successive frames are recorded (see step 510), and a determination is made as to whether these constitute a single object (see step 520). The object recognition algorithm further refines the template by performing edge detection on a video frame in the neighborhood of the coarse template (see step 530). The resulting boundaries improve the template size and shape, and the updated template is used to perform correlation tracking 540.

A centroid tracking algorithm (580) is also implemented by generating motion vectors (step 550) and analyzing the image flow (560) in the vicinity of the low correspondence regions recorded by the low correspondence detector (510). The two tracking algorithms work in parallel and support each other to maintain a steady fix on the targets. A pattern matching algorithm (570) is employed to filter out false hits by matching the size and shape of the object template against predefined size and shape parameters. Tracking synchronization information 590 is transmitted to the pan/tilt/zoom control block 451 in order to track the detected object.

The camera units are also preferably capable of distinguishing between an object that is relevant to its monitored environment (e.g., an intruder walking down a hallway) and an irrelevant object (a mouse scurrying down the hallway).

US 6,954,859 B1

15

This is accomplished by programming the processor 439 to classify the size of the detected object based upon the number of pixels the object fills in the camera's field of view. The camera units may be individually programmed via an authorized customer work station or an administrator work station to detect only certain sizes of objects based on its monitored environment and field of view.

In addition to detecting the relative size of a detected object, the camera units 400 are also capable of detecting the direction of a detected object's movement. This feature may be utilized to detect certain predefined events or to decide whether to provide a snap shot. For example, a camera unit may be installed opposite an entrance door to a room so that only objects moving into the room (as opposed to out of the room) are of interest in terms of detecting an event or transmitting a snap shot of the object. Once an object is detected by the camera unit, the object may be tracked frame to frame as discussed above in connection with the object recognition/tracking algorithm. Based on the direction of the motion vectors computed by the DSP block 430, the processor 439 can determine the object's direction of movement. Assuming the camera unit has been programmed to transmit an alarm based on, e.g., someone entering a room through a monitored doorway, the camera unit can transmit an appropriate event packet as well as the relevant video signal and motion vector information. In this way, the display monitor at the customer and administrator workstations can visually indicate the direction of the detected object. Alternatively, the camera unit may be programmed to transmit a snap shot of the object moving into the room.

These techniques may also be used to track and zoom in on a face or other portion of a human body so that a high resolution snap shot may be taken and stored. The zooming operation will now be described. First, processor 439 writes zoom parameters into registers of ASIC 409. The zoom parameters (namely, location within the video frame and zoom resolution) may be provided by the processor 439 responsive to detecting an object moving (e.g., a person) or some other pre-defined event; alternatively the zoom parameters may be provided by the processor 439 pursuant to instructions transmitted to it by a user at either of a customer or administrator work station. The ASIC 409 then sends the zoom parameter information to scaler 412; alternatively the scaling function may be carried out by the FPGA 415. The scaler then zooms in on the selected region of interest provided by the zoom parameters, and transmits the zoomed video signal.

By analyzing the magnitude of the motion vectors associated with a detected object against the frame rate of the incoming video signals, the processor 439 may also calculate the speed of a detected object. Thus, objects that are moving too fast or too slow may be classified as not constituting an event.

As discussed above, the event detection features of each camera unit are also programmable to be time sensitive. For example, a camera unit may be programmed to transmit an alarm when there is no motion detected during a time of day where motion should be detected. For example, a camera unit may be installed in a room where bank employees constantly enter (or a room where employees report to work). If no motion is detected for a predetermined period of time during a programmed time of day where motion is expected, the camera unit transmits an alarm event to its customer server and the administrator server. Conversely, each particular camera unit may be programmed to transmit an alarm where there is an abnormal amount of motion or objects in its field of view. For example, a camera unit may

16

be installed in a bank's safe room, and programmed to transmit an alarm if it detects too much movement over a predetermined period of time or too many objects (e.g., people) in the room.

Similarly, a camera unit may be programmable to transmit an alarm only after detecting certain types of activity for a predetermined period of time. For example, a camera unit may be installed in an alley way, and programmed to detect and transmit a loitering alarm event when an object is detected in its field of view and stays within its field of view for a predetermined period of time.

Each frame of video and audio information transmitted by the camera units includes information in a header that describes the frame. The header information includes: the camera unit's system identification number, time stamp information, the compression algorithm used to compress the frame, the size of the frame, the bit rate of the frame, and any relevant event tagging information describing the associated event. By including this information for each frame of video and audio information, the camera units can change the bit rate, the size of a video image, and the compression algorithm used on incoming video and audio signals on a frame by frame basis.

The header information for the event packets include for each event packet: the camera unit's system identification number, time stamp information, and the coded information describing the event.

The header information contained in the audio and video information and the event packet information allows the customer servers 40, the customer work stations 30, the administrator server 10, and the administrator work stations 20 to intelligently process, store, and display (as appropriate) these differently formatted frames.

In particular, the customer servers 40 and administrator server 10 capture the packets of frames of audio, video, and event data information transmitted by the camera units, analyze the header information contained in the frames, and build them into either video and/or audio frames or event data for storage and archival. The time stamp information in the headers of the video, audio, and event data information is used by the customer servers 40 and administrator server 10 to associatively index the event data with the corresponding video and/or audio information. The coded information in the event packets describing the event and the event tagging information in the audio and video frames may also be used to facilitate such indexing. This process is repeatable "n" times, once per camera unit channel (of which there are preferably multiple video, audio, and command/event channels). This allows multiple simultaneous streams to be stored, which in turn can be distributed to any number of customer or administrator work stations because the customer and administrator servers preferably have a dedicated communication talker for each connected work station.

Because the system is capable of generating and storing frames with arbitrarily changing properties, a specialized reader is also needed at the customer and administrator work stations. The user interface components of the customer and administrator work stations are designed to process successive frames of information that have differing compression algorithms, image size, bit rates, and other relevant header information. The header information contained in the information transmitted by the camera units is analyzed by the reader to allow the work stations to efficiently process and display such frames.

The camera units also preferably have a dedicated channel for each video compression algorithm technique. This advantageously allows the camera units to transmit different

US 6,954,859 B1

17

images of the same scene simultaneously. This will be described in connection with FIG. 6. The H.263 video standard calls for a resolution of 352×288, while currently available CCD imagers are capable of providing images of 1024×1024 and higher. Thus, H.263 frames of video can be sampled as shown in FIG. 6, while simultaneously transmitting, e.g., 1024×1024 JPEG frames. The camera units, the servers, and the workstations, are also capable of handling other compression algorithm formats such as but not limited to Wavelets, MPEG-1, MPEG-2, MPEG-4, and MPEG-7, and the camera unit can simultaneously transmit video frames in these formats as well. These simultaneously transmitted, differently formatted frames may also differ in terms of bit rate, pixel coding depth, frame rate, and image size. By analyzing the header information contained within these frames, the multi-algorithm readers at the customer and administrative work stations and the customer and administrator servers can simultaneously read and display (as appropriate) these frames.

As described above, the camera units preferably time stamp the audio and video frames and the event data information as they are generated. The internal clock (preferably at the processor) used by a particular camera unit is preferably periodically updated via its customer server or the administrator server to reflect the exact correct time. Accordingly, a drift of more than a few milliseconds before a clock reset could cause the frames or event packet information to be stamped out of order. In order to prevent this, when the camera units receive correct time clock resets, the units do not immediately correct their internal clocks. Rather, the camera units shift their internal clocks by one millisecond (or some other negligible amount) per frame towards the received correct time so as to reduce the possibility of frames or event packet information being stamped out of order.

The camera units also include an intelligent automatic gain controller, an encoder buffer controller, and an intelligent network bandwidth controller that intelligently controls the transmission rate of signals outputted by the camera units based on network collision rates and the priority of each respective camera unit. These aspects of the camera units will now be described. The intelligent gain controller in the camera units is responsible for automatically adjusting the gain of the camera system so as to provide substantially constant image luminance for varying lighting conditions, and includes (with reference to FIG. 7) the camera system 710 (blocks 403–409 of FIG. 4); encoder 720 (a component of DSP block 430 of FIG. 4); and control block 730. Control block 730 is preferably a software program running on processor 439 of FIG. 4. Camera system 710 calculates and provides mean, maximum, and minimum intensity parameters to control block 730 on signal line 740. The encoder 720 calculates and provides variance (dynamic range) and delta (amount of motion) information to control block 730.

As illustrated by flowchart diagram FIG. 8, the control block receives the mean, maximum, minimum, variance, and delta inputs at step 800, and then converts the real world inputs into their respective fuzzy equivalents (step 810). These fuzzy equivalents could, e.g., be a number between the range of 1 to 100. The five fuzzy equivalents are then compared (step 820) against a rule database that contains specific gain control instructions for different ranges of mean, maximum, minimum, variance, and delta fuzzy values. Based on the comparison step, the fuzzy control block outputs (step 830) a gain control signal on signal line 750 to the camera system 710. Specifically, the gain control signal

18

is transmitted via signal line 440 of FIG. 4 to camera ASIC 409 of camera system 401 as shown in FIG. 4.

As shown in FIG. 9, the camera units 400 also include a control system that controls the encoder buffer 930 of DSP block 430. The system includes the camera system 905, encoder 915, encoder buffer 930, and control block 940. Control block 940 is preferably a computer program running on processor 439. The control block 940 accepts as inputs input buffer and output buffer bit rates (950 and 960) calculated by the DSP block; alternatively it may receive buffer level information as computed by the DSP. The control block 940 provides as outputs a control signal to digital filter 910 contained within ASIC 409 of FIG. 4 and a quantization step size control input to quantization step size control unit of encoder 915.

The purpose of the control system of FIG. 9 is to ensure that encoder buffer 930 of DSP block 430 does not overflow (e.g., due to an absence of read requests from processor 439 of FIG. 4), while also optimizing the processing capabilities of the DSP block. The control block 940 increases the quantization step size 990 to reduce the in buffer bit rate 950, and decreases the quantization step size to increase the in buffer bit rate. The digital filter control signal 970 adjusts the input filtering of the incoming video signal 995 by instructing digital filter 910 in ASIC 409 to adjust the input video frequency. For example, the control block may instruct digital filter 910 to smooth out the incoming video signals by eliminating the high frequency content of the incoming video signals so that the encoder can more quickly process the incoming data.

FIG. 10 illustrates the preferred model predictive control algorithm that is utilized by the present invention to control the encoder buffer level. Modeling block 1010 receives as inputs the past inputs and outputs 1018 of modeling block 1010 and a present input 1015. The past inputs are the past digital filter and quantization step size control inputs (outputs 970 and 980 of FIG. 9), and the past output is the estimated future buffer level output. These inputs may be respectively represented by the equations $\{u(t-n), y(t-n), n \geq 1\}$ and $u(t)$, wherein $t = \text{time}$. The present input 1015 is the most recent output from control block 940 of FIG. 9.

The modeling block performs an adaptive filtering method or a normalized least square method (nLMS) on the input 1015 and past input and past output information 1018 in order to compute an estimated future buffer level 1019. The estimated future buffer level may be represented by the equation $\hat{y}(t+k/t)$ where $k=N_1$ to N_2 (N_1 being a minimal predicted horizon and N_2 being the maximum predicted horizon).

A summer 1020 then subtracts a future desired buffer level 1025 (which may be represented by the equation $(r(t+k))$) from the estimated future buffer level 1019 to compute a future error output 1028. The future error output is the error between the computed estimated future buffer level output 1019 and the future desired buffer level 1025. The future error output may be represented by the equation $\hat{e}(t+k/t)$, wherein $k=N_1$ to N_2 .

An optimizer block 1030 then computes a forced input signal 1035 using the equation:

$$J(N_1, N_2, N_u) = \sum_{i=N_1}^{N_2} \delta(i) [\hat{y}(t+i/t) - r(t+i)]^2 + \sum_{i=1}^{N_u} \lambda(i) [\Delta u(t+i-1/t)]^2,$$

US 6,954,859 B1

19

wherein N_1 is the minimal predicted horizon, N_2 is the maximal predicted horizon, N_u is the maximum control horizon, $\delta(i)$ is a weighting function on the future error, and $\lambda(i)$ is a weighting function on the control effort. The first half of the equation relates to the future error and the second half of the equation relates to the control effort. As shown in FIG. 10, optimizer block 1030 may also receive inequality constraints 1032 which, if used, provide caps on what the quantization and digital filter control outputs may be.

The forced input 1035 (which may be represented by the equation $u_c(t) = \Delta u(t/t)$, $\Delta u(t+j-1/t)$, wherein $j=1$ to N_u) is then provided to a summer 1040. The summer 1040 sums the forced input 1035 with a free input 1055 (which is the forced input 1035 provided through a time delay 1050, and which may be represented by the equation $u_f(t) = u(t-1)$) to provide the input 1015.

In addition to the control system of FIGS. 9 and 10, the camera units 400 also include a network priority bandwidth controller. Each camera unit preferably includes customized software running on processor 439 (FIG. 4) that allows it to autonomously increase or decrease the transmission delay of signals output onto a network by the camera unit as a function of network collision jam signals (e.g., IEEE 802.3 jam signals) received by processor 439 and the priority of the camera unit. The priority of the camera unit may depend on whether, and what type of event data, the camera unit is transmitting at a particular time. The priority determination of the camera may also include variables as to where the camera unit is located (high priority location versus low priority location) and whether the camera unit is in an alarm on or alarm off state.

According to the scheme, lower priority camera units can increase their transmission delay to relieve congestion and decrease it slowly when the collision rate is reduced. Depending on the collision rate, higher priority camera units could maintain their transmission delay or slowly increase their transmission delay in response to collisions. If there are lower priority camera units on the network, they will relieve the congestion, leaving the higher priority camera units with more bandwidth. The higher priority camera units can also aggressively decrease their transmission delay as the collision rate decreases.

The network priority bandwidth scheme implemented by processor 439 is depicted in the flowchart of FIG. 11. The algorithm is a perpetual loop wherein the processor determines (1110) the collision rate and camera unit priority and adjusts (1120) the transmission delay based on the camera priority and collision rate. In the preferred embodiment, the transmission rate adjustment is based on a proportional integral differential loop.

As can be readily appreciated, this network priority bandwidth scheme may be used in any network environment. For example, computers and other nodes that are connected on the same network segment as the camera units may also include software running the network priority bandwidth scheme of the present invention, wherein the priority level of the computer or some other node depends upon its mode of operation at any given time. The network priority bandwidth scheme may also be utilized in a network environment that does not include the camera units of the present invention. In such a case, there should be a bypass mechanism to allow TCP acknowledgments of successfully received packets to bypass the transmission delay. This will prevent nodes outside the collision domain segment from erroneously retransmitting data that has successfully been received by node(s) within the collision domain segment.

20

Features of the user interface will now be described in connection with FIGS. 12 and 13. Once a customer is authenticated by the administrator web server and has selected a specific monitored site (or an administrator employee at an administrative workstation has selected a specific monitored site), he is preferably presented with a floor plan layout window 1210, a viewing window 1230, and an event information window 1240. Each of the windows are resizable and moveable. The floor plan layout window 1210 shows the relative location of each camera unit 1220 on the floor shown, an indication 1222 (such as blinking) of whether a particular camera unit is experiencing an event state, and the particular event state of the camera unit 1223. The user may move from floor to floor by clicking on buttons 1212. If the user clicks on one of the camera units 1220, video information is streamed to the user's workstation and displayed on the viewing window 1230 in substantially real time.

Video control buttons 1233 are then provided, and the date and time are also shown in viewing window 1230. The user may transmit zoom instructions by, e.g., using his cursor to draw a box around the portion of the image he would like to zoom in on, or by clicking on an area of the image he would like to zoom in on. The user may then via the user interface cause the display to provide the original un-zoomed image. One of video control buttons 1234 allows the viewer to view several streams of video information simultaneously.

The event information window preferably lists the type of stored information 1251, the channel number 1252, the location of the channel 1253, the event time 1254, and the event duration 1255. If the user clicks on one of the events 1250 in the event information window 1240, the associated video and/or audio clip is streamed to the user's workstation and displayed on viewing window 1230. The event information window is updated as events occur, regardless of the viewing mode.

The viewer may alternatively search for stored video and audio information. The viewer may search for the desired information by inputting information via the user interface regarding any of the following: floor, channel (camera video or audio channel), event type, date, and time span. The search results are then displayed in a format that allows the viewer to view and/or listen to the retrieved audio and video information.

The viewer may also advantageously access a "piano roll" window interface. This interface is shown in FIG. 13. The "piano roll" interface schematically represents event durations for channels (camera video or audio channel) by using time bars 1342. The various channels are preferably listed in the piano roll interface window 1340 chronologically by the start time of the various events. In this way, the viewer can quickly determine how events between various channels interrelate. For example, by analyzing the time bars 1342 against the floor plan layout of window 1310, the viewer could quickly surmise that an intruder entered the floor by breaking the window 7 (see audio time bar on channel 3 and time bar on channel 4). The intruder's movements were then captured on video in an overlapping manner by channel 4, channel 3, channel 2, and channel 1. By clicking on the various time bars, the user may view and/or listen to the segments represented by time bars 1342 in viewing window 1330.

While the invention has been described in conjunction with specific embodiments, it is evident that numerous alternatives, modifications, and variations will be apparent to those skilled in the art in light of the foregoing descrip-

US 6,954,859 B1

21

tion. For example, while the invention has been primarily described in connection with a digital security system. The system of the present invention could also be used to collect marketing and customer service research at retail establishments, assist in quality control in manufacturing locations, and document personnel issues. These and all other such alternatives, modifications, and variations to the present invention are considered to be within the scope of the invention as defined by the claims of the invention that are now or may later be presented. The inventors intend that all patentable subject matter disclosed herein eventually be the subject of patent claims.

What is claimed is:

1. A digital security system comprising:

at least one camera unit for capturing and transmitting frames of video and/or audio signals over a communication network, wherein said camera unit is programmable to perform at least one of the following: to transmit a snap shot, streaming video, or an event clip upon detecting a predefined event, to simultaneously transmit a snap shot, streaming video and an event clip or combinations thereof upon detecting a predefined event, and to detect different predefined events based on the time of day, the camera unit includes a network bandwidth controller that adjusts the signal transmission delay of the camera unit as a function of a network collision rate and priority of the camera unit;

at least one customer server coupled to the camera unit via the communications network;

at least one customer work station coupled to the customer server via the communications network;

an administrator server coupled to the at least one customer server via the communications network, wherein the administrator server receives event packets and associated video and/or audio information, and intelligently routes the event packets and information to one or more administrator work stations; and

authentication means at the administrator server for authenticating a customer at the at least one customer work station so as to allow the work station to receive the video and/or audio signals transmitted by the at least one camera unit.

2. The system of claim 1, wherein the camera unit transmits video and/or audio signals over the communications network only after detecting a predefined event.

3. The system of claim 1, wherein the camera unit transmits video and/or audio signals over the communications network in response to receiving a command from a user at the customer work station or at least one administrator work station.

4. The system of claim 1, wherein the camera unit tags the frames of video and/or audio signals based upon detecting one of a plurality of predefined events.

5. The system of claim 1, wherein the camera unit transmits at least one event packet when a predefined event is detected.

6. The system of claim 1, wherein the camera unit is operable in a plurality of modes.

7. The system of claim 6, wherein the camera unit may be remotely configured to operate in one of the plurality of modes via the at least one customer work station.

8. The system of claim 1, wherein the camera unit includes a glass break detector.

9. The system of claim 8, wherein the glass break detector includes: an audio input receiver means, a digital signal processor for computing spectrograms of incoming audio

22

signals, and a means for comparing a predefined glass break spectrogram template against the spectrograms computed by the digital signal processor.

10. The system of claim 1, wherein the camera unit includes a motion detector that analyzes the video signals captured by the camera unit.

11. The system of claim 10, wherein the motion detector comprises a digital signal processor that includes an automatic learn component that automatically updates a stored background image against which the digital signal processor performs motion analysis detection.

12. The system of claim 10, wherein the camera unit increases one or more of the bit rate, pixel coding depth, the image size, frame rate, and compression algorithm format associated with the video signals in response to detecting motion in the video signals.

13. The system of claim 10, wherein the camera unit includes an object detector.

14. The system of claim 10, wherein the camera unit includes an object speed detector.

15. The system of claim 14, wherein the camera unit determines whether to transmit an event packet over the network based on the speed of the detected object.

16. The system of claim 10, wherein the camera unit includes an object movement detector that detects the direction of movement of a detected object.

17. The system of claim 16, wherein the camera unit determines whether to transmit at least one event packet over the network based on what direction the detected object is moving.

18. The system of claim 1, wherein the authentication means includes means to compare inputted user identification information against a database of monitored sites to which the user may access.

19. The system of claim 1, wherein the administrator server includes means for receiving event packet information from the at least one camera unit, and means for transmitting relevant contact information to one or more administrator work stations.

20. The system of claim 1, wherein the administrator server includes means for receiving the event packet information from the at least one camera unit and means for automatically contacting one or more of the local police, local fire department, and customer contact.

21. The system of claim 1, wherein the camera unit includes: a camera system; an encoder coupled to the camera system that encodes the video signals transmitted by the camera system; and an automatic gain controller coupled to the camera system and the encoder, the automatic gain controller receiving mean, maximum, and minimum intensity video signal values from the camera system, and variance and delta values from the encoder, and providing in response a control signal that controls the gain of the camera system so that the camera unit transmits video signals with substantially constant image luminance for varying lighting conditions.

22. The system of claim 1, wherein the camera unit includes:

a camera system;

an encoder coupled to the camera system that encodes the video signals transmitted by the camera unit;

an encoder buffer coupled to the encoder; and

an encoder buffer controller coupled to the camera system and the encoder buffer, the encoder buffer controller receiving as inputs an in buffer bit rate input from the encoder, and an out buffer bit rate from the encoder buffer.

US 6,954,859 B1

23

23. The system of claim **1**, wherein the camera unit autonomously determines its priority based on the type of predefined event it is experiencing.

24. The system of claim **1**, wherein the camera unit is coupled to a conventional sensor.

25. The system of claim **24**, wherein the camera unit is configured to receive an alarm signal from the conventional sensor, and to transmit an event packet over the network in response to receiving the alarm signal from the conventional sensor.

26. The System of claim **25**, wherein the camera unit starts transmitting video and/or audio signals in response to receiving the alarm signal from the conventional sensor.

27. The system of claim **25**, wherein the camera unit changes a characteristic of transmitted video and/or audio signals in response to receiving the alarm signal from the conventional sensor.

28. The system of claim **24**, wherein the camera unit performs boolean analysis of an alarm signal sent by the conventional sensor and an event detected by the camera unit before transmitting an event packet over the network.

29. The system of claim **1**, wherein the camera unit simultaneously transmits video signals in more than one compression algorithm standard format in response to detecting certain predefined events.

30. The system of claim **1**, wherein the camera unit simultaneously transmits video signals according to the JPEG format and the H.263 format in response to detecting certain predefined events.

31. The system of claim **1**, wherein the camera unit simultaneously transmits video signals having differing bit rates.

24

32. The system of claim **1**, wherein the camera unit simultaneously transmits video signals having differing frame rates.

33. The system of claim **1**, wherein the camera unit simultaneously transmits video signals having differing pixel coding depths.

34. The system of claim **1**, further comprising at least one administrator workstation coupled to the administrator server.

35. The system of claim **34**, wherein a graphical user interface is provided at one of the administrator or customer workstations, and wherein the graphical user interface schematically displays event durations for a plurality of camera units.

36. The system of claim **34**, wherein the video or audio information schematically represented by the event duration display is accessible by a user clicking on the event duration display.

37. The system of **34**, wherein the customer and administrator work stations include a multi-algorithm reader that allows the work stations to display successive frames of video signals encoded in different compression algorithm standard formats.

38. The system of claim **4**, wherein the camera unit tags the frames of video and/or audio signals by inserting information in the header of the transmitted frames that identifies the predefined event.

39. The system of claim **5**, wherein the event packet includes information in the header of the event packet that identifies the predefined event.

* * * * *

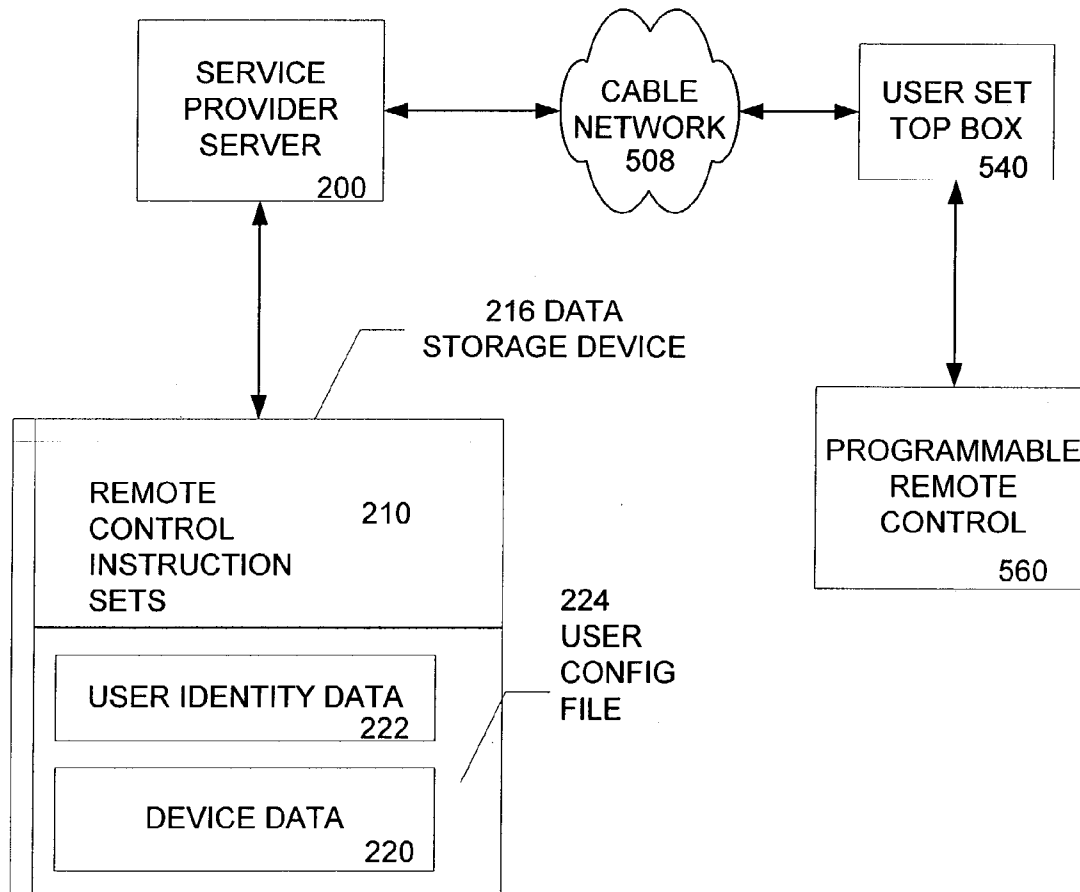
US 20040119894A1

(19) **United States**(12) **Patent Application Publication****Higgins et al.**(10) **Pub. No.: US 2004/0119894 A1**(43) **Pub. Date: Jun. 24, 2004**(54) **SYSTEM AND METHOD FOR
PROGRAMMING A PROGRAMMABLE
REMOTE CONTROL DEVICE**(52) **U.S. Cl. 348/734; 725/132**(76) **Inventors: Rich Higgins, Colorado Springs, CO
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RESTON, VA 20191 (US)**(21) **Appl. No.: 10/328,398**(22) **Filed: Dec. 24, 2002****Publication Classification**(51) **Int. Cl.⁷ H04N 7/173; H04N 5/44**(57) **ABSTRACT**

A method wherein a programmable remote control (PRC) is programmed from a configuration file over a network. A user configuration file comprises data associating the user configuration file with a unique user and information about devices that a user desires to control with a PRC. A service provider uses the device records to find the appropriate remote control instruction set for each device to be controlled by the PRC. Upon notification of a change in the devices that a user desires to control, the service provider would update the user configuration file. Optionally, the service provider would not only program the PRC, but using the PRC would assist the user in programming each device that is controlled by the PRC (to the extent such devices are programmable).



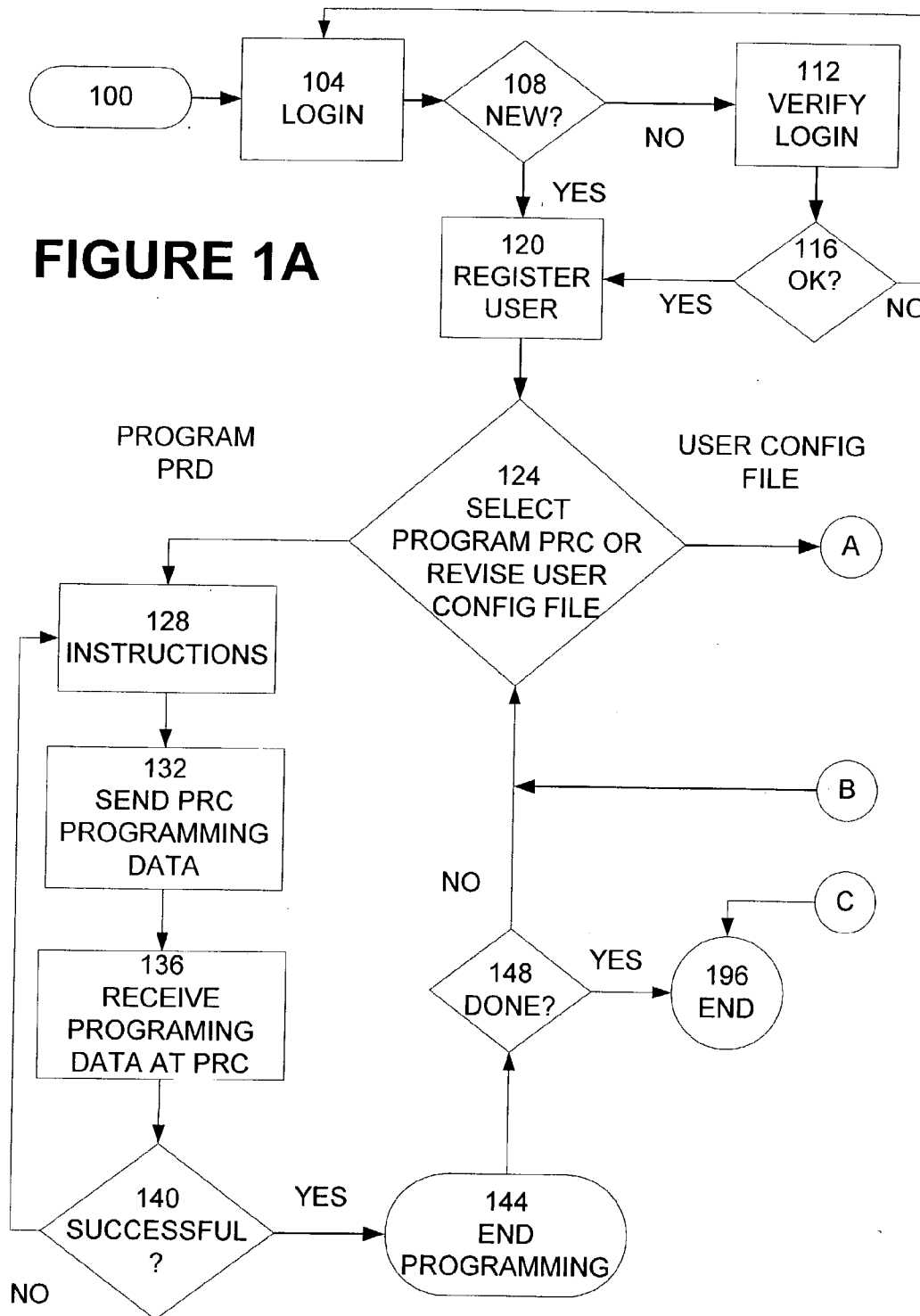


FIGURE 1B

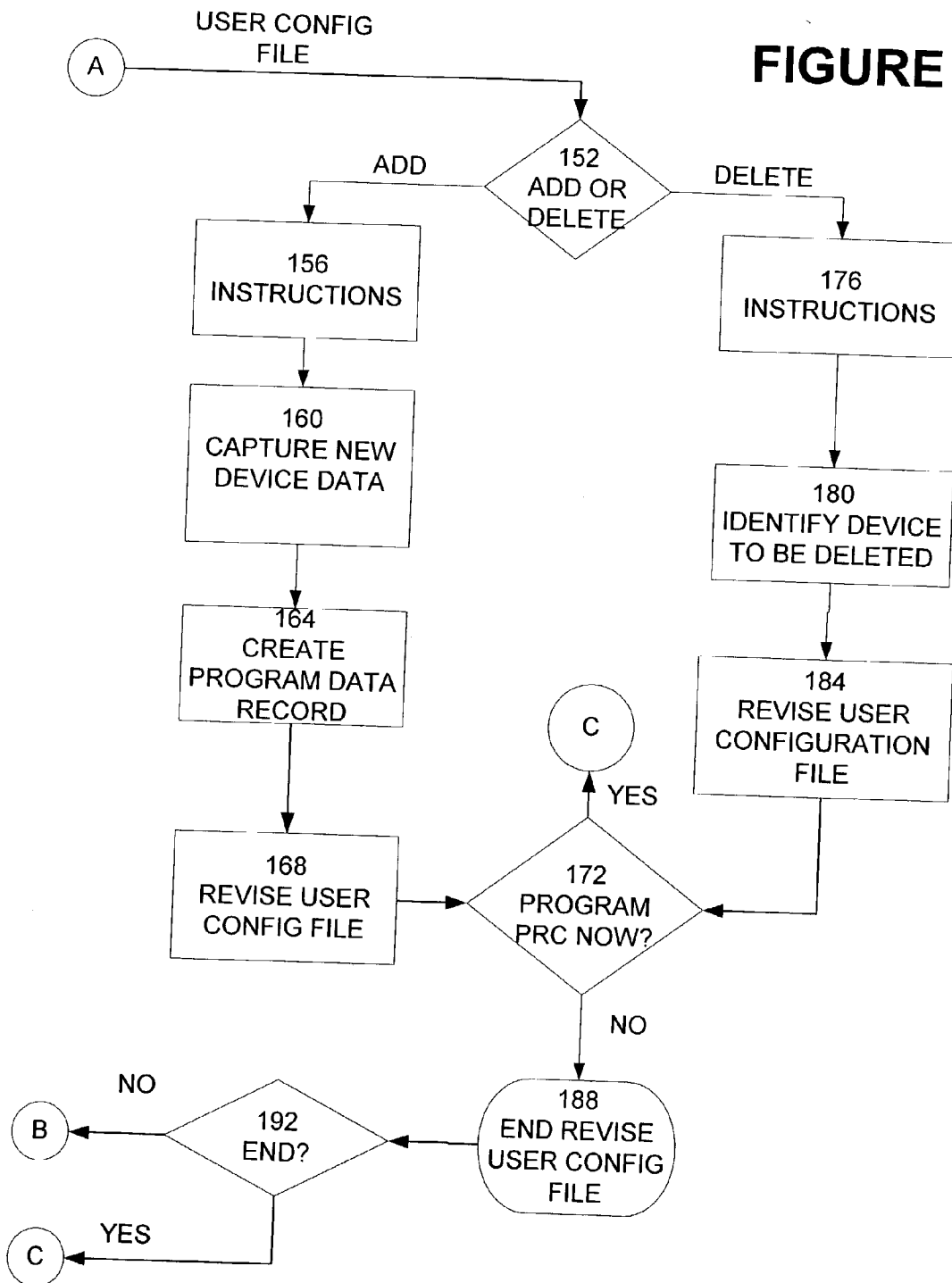


FIGURE 2

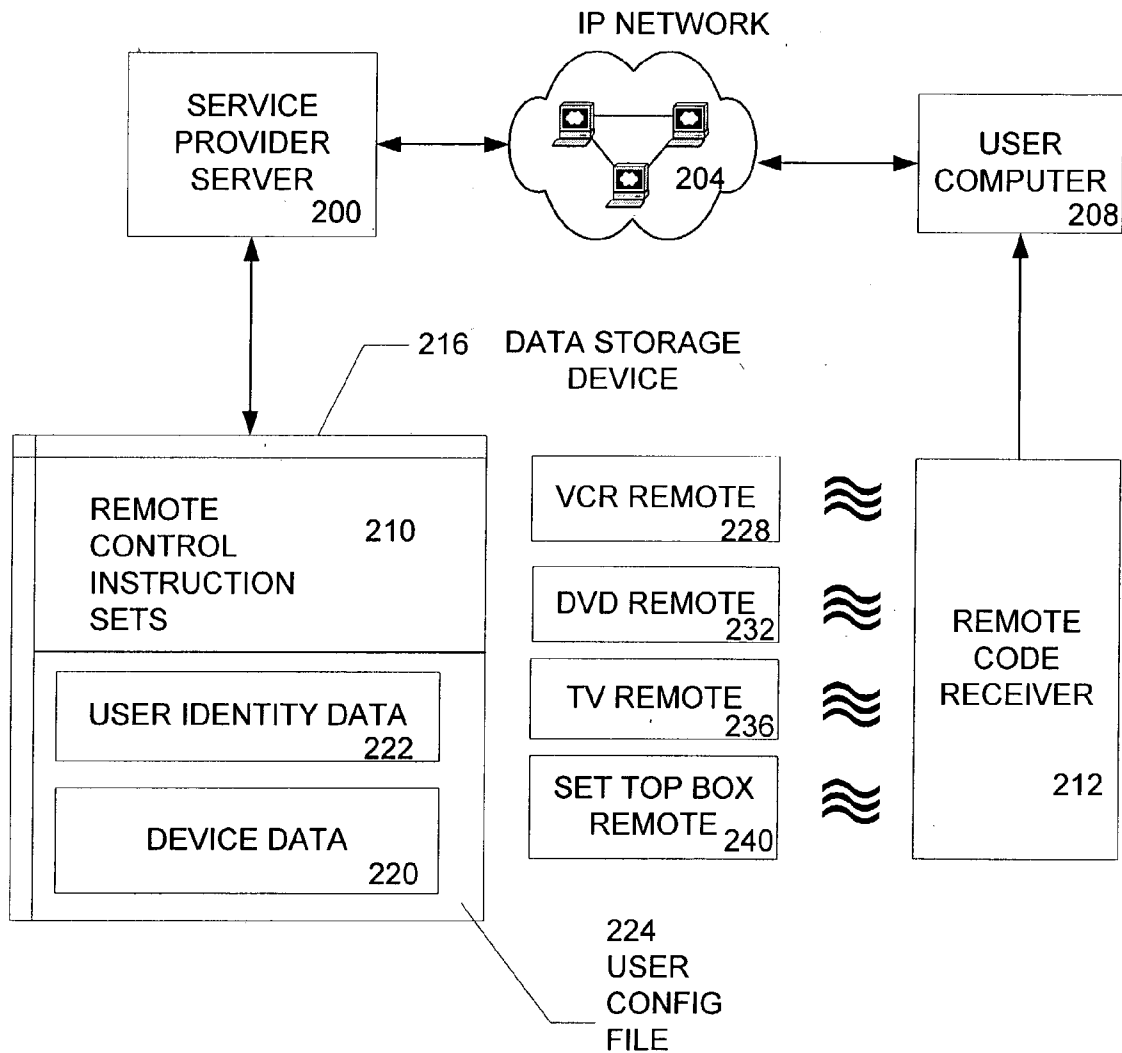


FIGURE 3

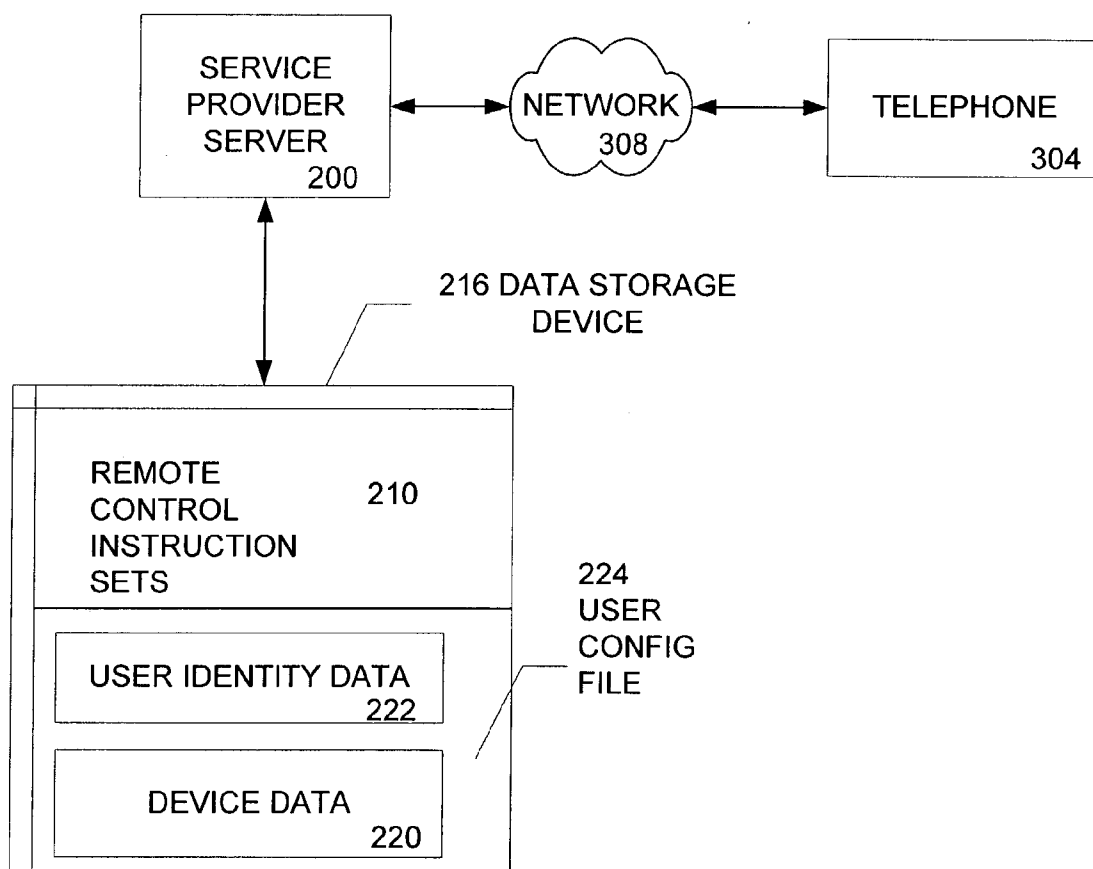


FIGURE 4

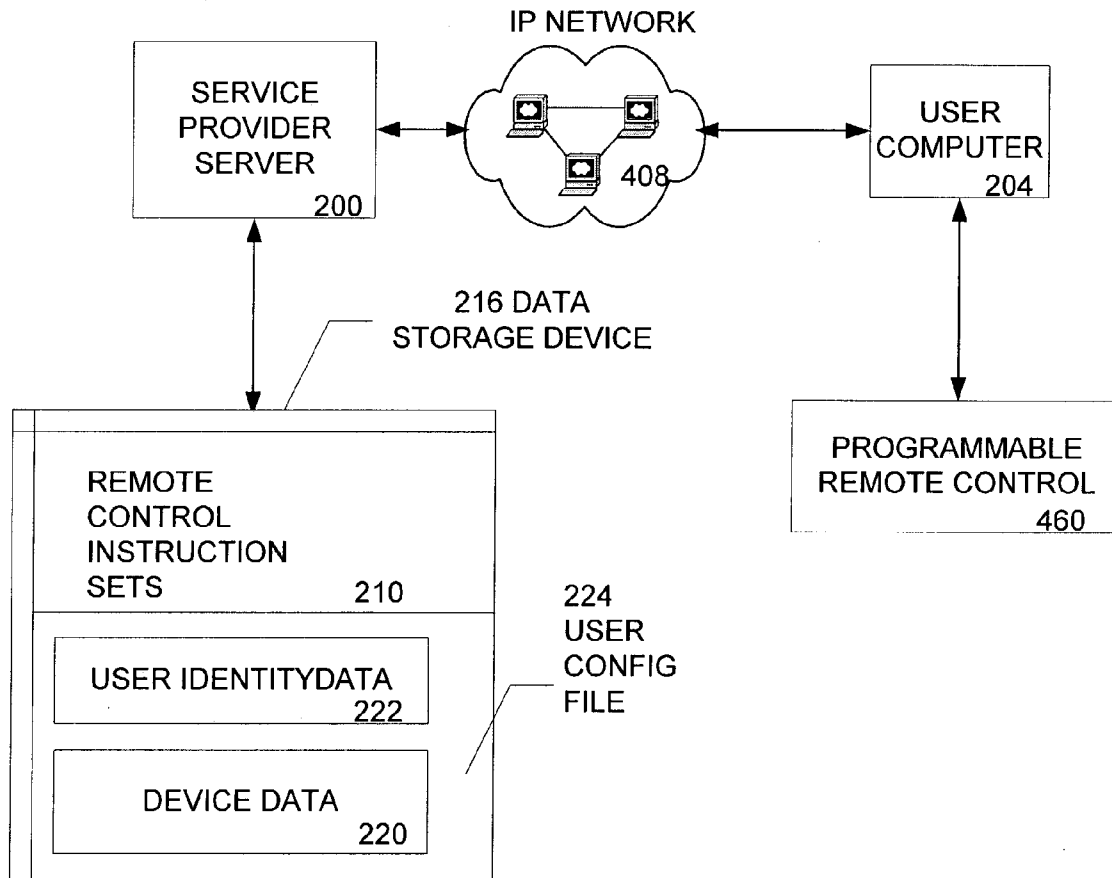


FIGURE 5

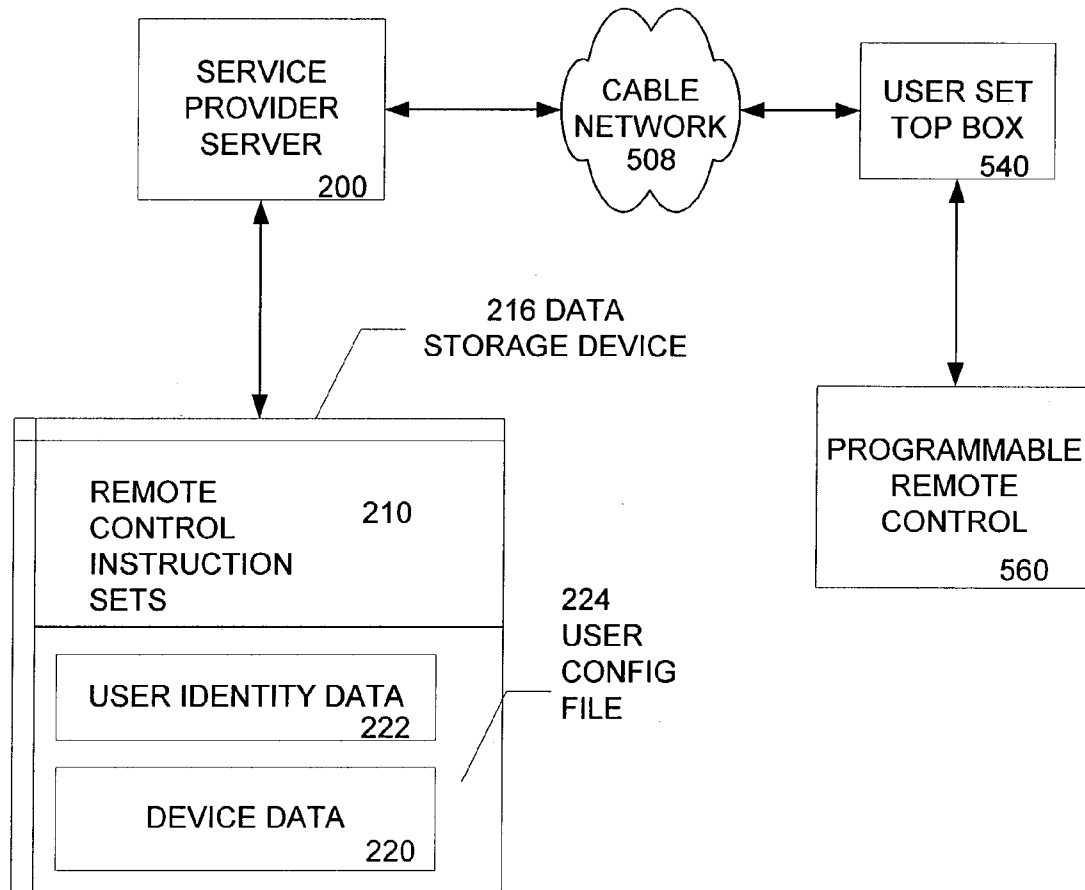
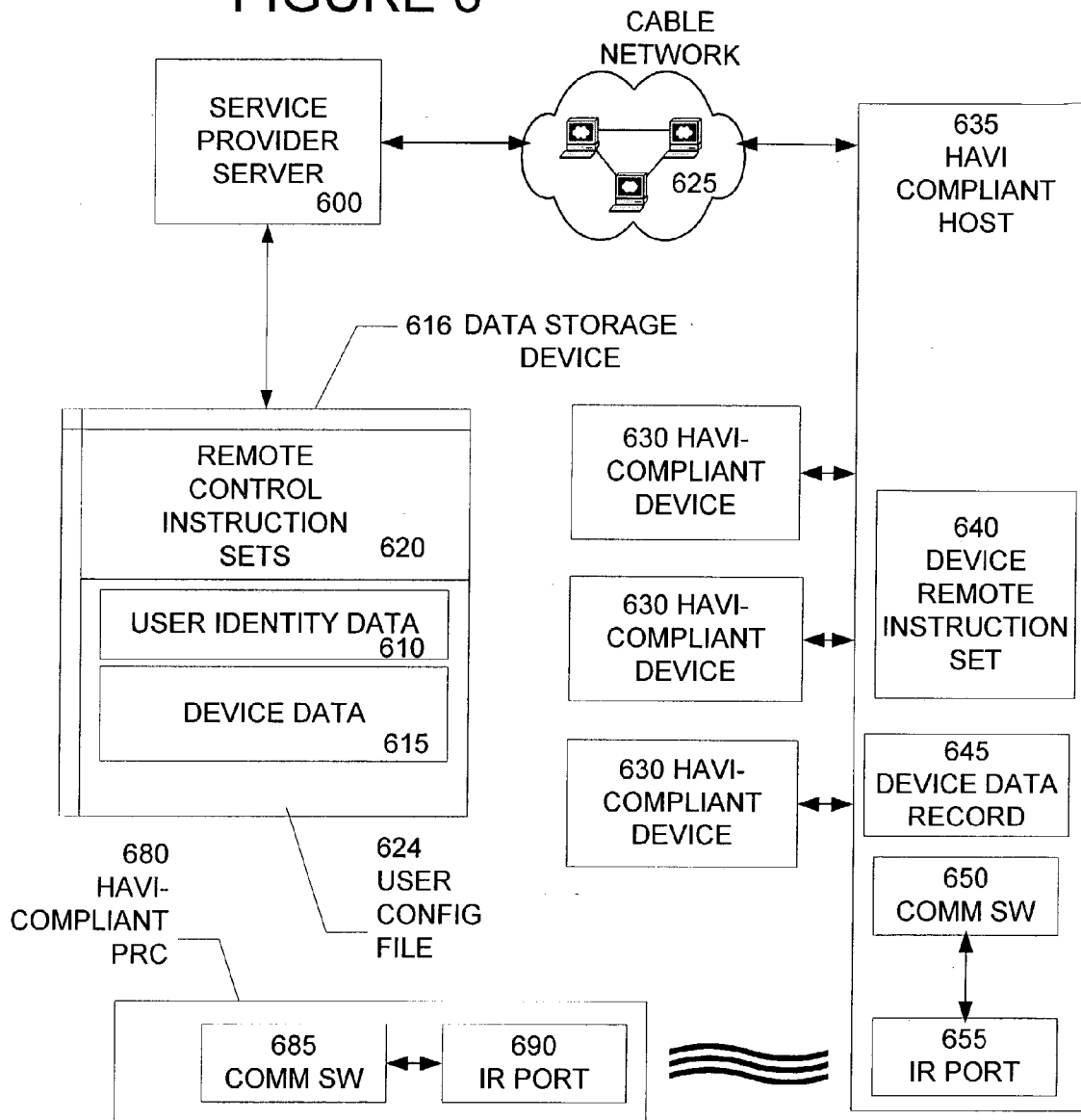


FIGURE 6



US 2004/0119894 A1

Jun. 24, 2004

1

SYSTEM AND METHOD FOR PROGRAMMING A PROGRAMMABLE REMOTE CONTROL DEVICE

FIELD OF THE INVENTION

[0001] The present invention relates generally to the field of programming remote controls for consumer devices. More specifically, the present invention provides a method wherein a remote control is programmed by a third party over a network.

BACKGROUND OF THE INVENTION

[0002] Consumer devices, particular audio and video devices, are accessible through wireless remote control units (remotes). Typically, remotes send commands using infrared (IR) light as the carrier. The IR command set is unique for each manufacturer and device specific.

[0003] The first such devices were simple television remotes that allowed a user to select a channel, a volume setting, and to power the television set on and off. As televisions began to offer more features, the remotes also evolved into more flexible, albeit more complex, devices.

[0004] In the 70's, VCRs were introduced and the era of multiple remotes was born. Not only were users compelled to deal with separate remotes, but also the devices these remotes controlled became "programmable." VCRs could be programmed for specific channels and languages and to record a program at a time in the future. Televisions were not only programmable with respect to the language and viewing channel, but with respect to a myriad of audio and video options as well. The audio/video (AV) receiver arrived with the introduction of Dolby Surround Sound. The AV receiver was also controllable remotely and programmable adding another later of complexity. Today, a basic entertainment center comprises a television (or monitor), a VCR, a DVD player, an AV receiver, a CD player, a set top box (for cable), and a digital video receiver (for digital television and HDTV reception). Additionally, fans, lights, gas fireplaces and other appliances are controllable using IR remote controls.

[0005] The proliferation of remote controls lead some manufactures to include "learning remotes" with their products. For example, the remote that controls the television set typically has a set of basic buttons to control a VCR and a database of VCR remote control codes. The remote is "told" what model of VCR is being operated and selects a remote control instruction set for that VCR. The remote control instruction set associates buttons on the remote control with commands that can be executed by the VCR. Alternatively, some remotes come with a learning mode that allows the remote for one device to teach its command list to a "master" remote. Because the remote typically has a limited number of buttons, the learning or master remote typically cannot capture all of the commands of the teaching remote. Thus, the original remote must still be available to handle certain tasks.

[0006] A popular solution to the multiple-remote problem is the programmable remote control (PRC). The PRC emulates the functionality of remote controls made by a plurality of manufacturers. PRC's use programmable buttons, virtual buttons displayed on a screen, or a combination of the two. Various techniques are used to train a PRC, including downloading device codes from the Internet.

[0007] U.S. Pat. No. 6,104,334 issued to Allport and entitled "Portable Internet-Enabled Controller and Information Browser for Consumer Devices," ('334) describes a number of alternative means for programming a PRC and the problems associated with each. '334 teaches a PRC with an integrated graphical display that does not utilize the television screen for programming purposes and that can obtain a remote control instruction set either from a pre-loaded database of such commands or over the Internet.

[0008] U.S. Pat. No. 5,410,326 issued to Goldstein entitled "Programmable Remote control Device For Interacting With a Plurality of Remotely Controlled Devices," ('326) describes a PRC that receives programming information over a link to cable converter or a telephone interface. An aspect of the '326 patent is that the user need not perform any elaborated programming steps to program the PRC. The programming of the PRC is also described in terms of a service to be provided by a cable system head end to its subscribers. While programming a PRC through a third-party interface is helpful, the user of the PRC must still be knowledgeable about the devices that are controllable using the PRC. Should the PRC ever lose it's programming, the user must know which device codes to download. Similarly, if the user replaces the PRC or acquires a second PRC, the download process must be initiated by the consumer with knowledge of devices that the user desires to control with the PRC.

[0009] A recently proposed Home Audio Video Interoperability (HAVi) standard seeks to address some of these problems. The HAVi specification is a consumer electronics (CE) industry standard design to permit digital audio and video devices that conform to this standard, regardless of manufacturer, to interoperate when connected via a network in the consumer's home. The HAVi standard uses the digital IEEE-1394 network standard for data transfer between devices and the 1394 A/VC protocols for device control.

[0010] The HAVi standard focuses on the transfer and processing (for example, recording and playback) of digital content between networked devices. HAVi-compliant devices will include not only familiar audio and video components but also cable modems, digital set-top boxes and "smart" storage devices such as personal video recorders (PVRs). In the future, other kinds of devices such as videophones and personal digital assistants (PDAs) also may become part of a HAVi home network. By letting a TV set, or any other device on the network that has a display capability, act as a network hub to both control and show the status of any connected device, compliance with the HAVi standard will make consumer electronic equipment easier to use. In a HAVi-compliant system, all of the networked components can be run from the TV with one remote control. A home PC will not be required for a HAVi-compliant system to operate and is independent of any operating system or microprocessor. However, a PC can act as a HAVi-compliant device, with the ability to control other connected devices.

[0011] Compliance with the HAVi standard also allows disparate brand devices to be hooked into a home network. A DV camcorder, video game player or even a refrigerator conforming to the HAVi standard could be plugged into a network and have its features automatically available for use by other devices on the network. From the consumer's

US 2004/0119894 A1

Jun. 24, 2004

2

perspective, all that is required is to select a task for a device and the HAVi host will order the task performed.

[0012] By employing modular software, the HAVi standard allows consumer electronics devices to identify themselves and what they can do when plugged into the host. The software functions by assigning a device control ID module to each hardware component of a system. Each system also is assigned multiple functional component modules, containing information about an individual device's capabilities, for example, whether a camcorder operates in DV format, or whether a receiver is designed to process AC3 audio.

[0013] HAVi-compliant devices automatically register their operating status, device functions and location with other components in the network. So when a host device recognizes a new component on a HAVi system, the host loads the appropriate device and functional modules, allowing users to control the target device from the host.

[0014] The features promised by the HAVi standard will only be available for HAVi-compliant devices. Further, the HAVi standard anticipates that the graphical user interface of the network of components is displayed on a television or other video display component of the system, thus requiring the video display component to be powered on when using a system device. If a user desires to use only the audio components of a system the video display must still be powered on.

[0015] The IEEE1394 A/VC protocol, which is a lower software layer than HAVi, can also be used in conjunction with other IEEE 1394 protocols (collectively referred to as "A/VC protocol") to transport configuration data among devices, although without HAVi interoperability of different brands is problematic. For example, a 1394 A/VC capable DVD could send profile information using the 1394 A/VC protocol to a compliant D-VCR. The D-VCR would then have access to the features of the DVD. As in the case of the HAVi standard, the 1394 A/VC protocol does not specifically address problems relating to programming a PRC nor does it guarantee interoperability among brands.

[0016] What would be useful would be a system and method whereby a service provider can program a PRC over a network using a user configuration file stored by the service provider and associated with the user.

SUMMARY OF THE INVENTION

[0017] An embodiment of the present invention is a method of programming a PRC using a user configuration file held by a service provider. In this embodiment, the service provider is a cable operator from whom the user obtains cable service, but the present invention is not so limited. By way of example and not as a limitation, a service provider may be a third party offering PRC programming services independent of any other relationship with the user or a third party providing satellite entertainment services to the user. As will be apparent to those skilled in the art of the present invention, other third parties may provide the PRC programming service without departing from the scope of the present invention.

[0018] A user configuration file comprises data associating a user with a unique user configuration file. The user configuration file comprises information about devices

(device data) that a user desires to control with a PRC. The service provider uses the device data to find the appropriate remote control instruction set for each device to be controlled by the PRC. The service provider conveys this remote control instruction set to the user for communication to the PRC. The remote control instruction set is then communicated to the PRC and the instructions implemented. Upon notification of a change in the devices that a user desires to control, the service provider updates the user configuration file.

[0019] It is an aspect of the present invention to eliminate the need for a user to program a PRC to operate with a device.

[0020] It is yet another aspect of the present invention for a service provider to maintain a user configuration file associated with a user wherein the user configuration file comprises a device record for each device that the user desires to control with a PRC.

[0021] It is still another aspect of the present invention for the user to notify the service provider of a change or addition to the set of devices that the user desires to control with a PRC and to receive from the service provider updated remote control instruction set for the user's PRC reflecting the change or addition.

[0022] It is an aspect of the present invention to obtain user configuration file data and updates to that data directly from a HAVi-compliant device.

[0023] It is an aspect of the present invention to permit the service provider to program one or more devices that are accessible through a user's PRC.

[0024] An embodiment of the present invention is a method of programming a PRC using a user configuration file held by a service provider. In this embodiment, a user configuration file comprises data associating a user with a unique user configuration file. The user configuration file comprises information about devices that a user desires to control with a PRC and the type of PRC possessed by the user. The service provider uses the device data to find the appropriate remote control instruction set for each device to be controlled by the PRC. The service provider conveys this remote control instruction set to the user for communication to the PRC. The remote control instruction set is then communicated to the PRC and the instructions implemented. Upon notification of a change in the devices that a user desires to control, the service provider updates the user configuration file. Optionally, the service provider not only programs the PRC but also assists the user in programming each device that is controlled by the PRC (to the extent such devices are programmable).

[0025] In another embodiment, a HAVi-compliant device (designated as the HAVi-complaint host) is connected to a plurality of HAVi-compliant devices. The HAVi-compliant devices share control information with each other and with the HAVi-compliant host. The HAVi-compliant host communicates the control information of each HAVi-compliant device connected to it to the service provider. From the control information, the service provider obtains the remote control instruction set for each HAVi-compliant device connected to the HAVi-compliant host. The remote control instruction sets are sent to the HAVi-compliant host, which

US 2004/0119894 A1

Jun. 24, 2004

3

in turn communicates the remote control instruction sets to a HAVi-compliant PRC and the instructions implemented.

BRIEF SUMMARY OF THE DRAWINGS

[0026] **FIGS. 1A and 1B** illustrate a general flow chart of an embodiment of the present invention according to an embodiment of the present invention.

[0027] **FIG. 2** illustrates a block diagram of a method of conveying information about devices that a user desires to control with a PRC to a service provider according to an embodiment of the present invention.

[0028] **FIG. 3** illustrates a block diagram of a method of conveying information about devices that a user desires to control with a PRC to a service provider according to another embodiment of the present invention.

[0029] **FIG. 4** illustrates a block diagram of a method of programming a PRC according to an embodiment of the present invention.

[0030] **FIG. 5** illustrates a block diagram of a method of programming a PRC according to another embodiment of the present invention.

[0031] **FIG. 6** illustrates a block diagram of a method of programming a PRC in a HAVi-compliant environment according to an embodiment of the present invention

DETAILED DESCRIPTION OF EMBODIMENTS OF THE PRESENT INVENTION

[0032] An embodiment of the present invention is a method of programming a PRC using device data held in a user configuration file held by a service provider. As used herein, a "device" comprises equipment that is controllable by means of a remote control. By way of example and not as limitation, a device may be a VCR, a DVD player, a television, or other A/V equipment, or a thermostat, a lighting system, or a fan. As will be apparent to those skilled in the art, other equipment that is controllable by use of a remote control may be used in conjunction with the present invention without departing from its scope.

[0033] Referring to **FIG. 1**, a general flow chart of an embodiment of the present invention is illustrated. A user initiates communication with a service provider **100**. Any number of means may be used for this communication, including by way of example and not as a limitation, using a user computer linked to the service provider over the public switched telephone network and using a user computer linked to the service provider over a cable network. The "computer" may be a PC, or it may be a set top box connected through a network to the service provider.

[0034] Once connected to the service provider, the user is asked to login **104**. A check is made to determine if the user is a new user or is if the user claims to have an account with the service provider **108**. If the user is new, the user registers with the service provider **120**. If the user claims to have an account with the service provider, the user verifies the account using standard login practice **112** known in the art. If the verification fails, the user is returned to the login process **104**. If the verification is successful, or if the user has completed the registration process, the user is invited to choose to either program a remote control using an existing user configuration file or to create or modify a user configuration file **124**.

[0035] The process for programming a remote control from an existing user configuration file begins with instructions issued by the service provider **128** to the user. In one embodiment of the present invention, these instructions are general instructions as to how to program a remote control. In another embodiment, the instructions are tailored to the user based on the user profile. By way of illustration, in this latter embodiment, the user profile comprises the model of the remote control to be programmed and the interface through which the programming will be accomplished, and the instructions proffered to the user are specific to the remote and the interface. The means by which instructions are delivered to the user depend on the device being used to communicate with the service provider. For example, instructions are provided as images on communication devices having video display capabilities. In an alternative embodiment, the instructions may be provided in audio format.

[0036] The remote control instruction set is sent by the service provider **132** and received by the PRC to be programmed **136**. The means by which the remote control instruction set is communicated to the PRC to be programmed is described below. In one embodiment, the remote control instruction set is provided over the Internet. In yet another embodiment, the remote control instruction set is provided over a cable network. However, these examples are not intended as limitations and as would be apparent to those skilled in the art of the present invention other means of conveying the remote control instruction set to the remote to be programmed may be used without departing from the scope of the present invention.

[0037] A check is made to determine if the programming of the remote was successful **140**. If not, the instructions are issued again **128** and the programming process is repeated. If the programming is successful, the programming process ends **144** and a check is made to determine if the user has other tasks to perform **148**. If no other tasks are to be performed, then the session with the service provider ends **196**. If other tasks are to be performed, then the user is again asked to choose between programming a PRC or creating or modifying a user configuration file **124**.

[0038] A user configuration file comprises information about devices that a user desires to control with a PRC and the device record associated with those devices and data associating the user configuration file with a unique user. In another embodiment of the present invention, the user configuration file further comprises information about a PRC and the interface by which the PRC receives device record. The device record is used to select a remote control instruction set for each device to be controlled by a PRC.

[0039] Referring again to **FIG. 1**, the flow following a user selection of creating or modifying a user configuration file is illustrated. The user selects whether information is being added to a user configuration file or deleted **152**. If a device is being added to a configuration file, the user is presented with instructions **156** and the new device data is captured **160**. A device record for the new device is added to a device record **164** and the user configuration file is updated **168**.

[0040] If a device is to be deleted from the user configuration file, the user is presented with instructions **176** and the device to be deleted is identified. The user configuration file is updated **184**.

[0041] Once a device has been added or deleted from the configuration file, the user is prompted as to whether the user

US 2004/0119894 A1

Jun. 24, 2004

4

desires to initiate reprogramming the user's PRC to reflect the revised configuration 172. If the user chooses to initiate programming the PRC, the process continues with the issuance of programming instructions 128. If the user elects not to program the PRC, revision of the user configuration file ends 188 and a check is made to determine if the user has other tasks to perform 192. If no other tasks are to be performed, then the session with the service provider ends 196. If other tasks are to be performed, then the user is again asked to choose between programming a remote or creating or modifying a user configuration file 124.

[0042] Referring to FIG. 2, a block diagram illustrating a method of conveying information about devices that a user desires to control with a PRC to a service provider. Configuration server 200 is connected to user computer 204 over network 208. User computer 204 is connected to remote code receiver 212. Configuration server 200 is connected to data storage device 216. Data storage device 216 comprises a user configuration file 224 and a file of remote control instruction sets 210. The file of remote control instruction sets 210 comprises a library of remote control instruction sets for a plurality of devices manufactured by a plurality of manufacturers.

[0043] User identity data 222 comprises information that associates the user configuration file 224 with a user. Device data 220 comprises device data that identifies devices of that user that are controllable remotely. By way of example, and not as a limitation, user configuration file 224 comprises device data 220 for a VCR, a DVD player, a television, and a set top box. This information is captured from VCR remote 228, DVD remote 232, TV remote 236, and set top box remote 240 through remote code receiver 216, each of which represent the remote control of the original equipment manufacturer of the device that it controls (an OEM remote). In this embodiment, an OEM remote is positioned so that its IR sending unit is capable of communicating with remote code receiver 216. A button of the OEM remote is pressed sending an encoded command to the remote code receiver 216 that in turn sends the encoded command to user computer 204.

[0044] In one embodiment, software on user computer 204 interprets the encoded command and determines the OEM of the OEM remote and the model of the product that the OEM remote controls. In another embodiment, the encoded command is sent to configuration server 200 and is interpreted by reference to the file of remote control instruction sets 210. In either embodiment, device data 220 relating to device to be controlled by the PRC is sent to user configuration file 224 and stored in association with a user identity data 222.

[0045] In another embodiment of the present invention, the remote command receiver is built into the PRC. In this embodiment, the PRC has an interface to the computer. By way of illustration and not as a limitation, the computer interface may be USB port, a serial port, IR, RF or other interface means.

[0046] In another embodiment of the present invention, information about devices that a user desires to control with a PRC is conveyed to the service provider over the public switched telephone network (PSTN) or a wireless telephone network using a telephone. Referring to FIG. 3, configuration server 200 is connected to a telephone 304 over network 308. Configuration server 200 is connected to data storage device 216. Data storage device 216 comprises a file of remote control instruction sets 210 and a user configuration file 224. Using voice prompts, the service provider instructs

the user to enter in the OEM of the device that the user desires to control with the PRC, the type of device (e.g., television, VCR, DVD), and other information necessary to identify the device. The user responds to the prompts by using the keypad of the telephone.

[0047] Once the user configuration file 224 is created, the device data 220 is used to select an appropriate remote control instruction set from the file of remote control instruction sets 210 for each device to be controlled by the PRC. The remote control instruction set is sent to the PRC.

[0048] Referring to FIGS. 4 and 5, two embodiments of the present invention for programming a PRC from a user configuration file 224 are illustrated. In both embodiments, configuration server 200 is connected to data storage device 216. Data storage device 216 comprises a file of remote control instruction sets 210 and a user configuration file 224. User identity data 222 comprises information that associates the user configuration file 224 with a user. Device data 220 comprises device data that identifies devices of that user that are controllable remotely. By way of example, and not as a limitation, user configuration file 224 has device data 220 for a VCR, a DVD player, a television, and a set top box. This information is captured as previously described.

[0049] Referring to FIG. 4, configuration server 200 is connected to user computer 204 over IP network 408. A PRC 460 is also connected to user computer 204 through a computer interface. By way of illustration and not as a limitation, the computer interface may be USB port, a serial port, or other interface means. Service provider 220 uses the device data 220 to select from the file of remote control instruction sets 210 the appropriate remote control instruction set for each device for which data is held in device data 220. The remote control instruction sets are conveyed by configuration server 200 over IP network 408 to user computer 204 and loaded in the PRC 460 via the computer interface.

[0050] Referring to FIG. 5, configuration server 200 is connected to users set top box 540 over cable network 508. A PRC 560 is in communication with set top box 540 through an interface. By way of illustration and not as a limitation, the set top box interface may be USB port, a serial port, or an infrared link. The remote control instruction sets are conveyed by configuration server 200 over cable network 550 to set top box 540 and loaded in the PRC 560 via the set top box interface.

[0051] As will be apparent to those skilled in the art, other means of conveying the remote control instruction set to the PRC may be utilized without departing from the scope of the present invention. By way of illustration, the remote control instruction set may be downloaded into the user computer 208 and then loaded into the PRC using software provided by the service provider.

[0052] FIG. 6 illustrates an embodiment according to the present invention in which HAVi-compliant devices are connected to a HAVi-compliant host. A HAVi-compliant host is a device in a HAVi-compliant network that acts as a hub for all other devices on that network. By way of illustration and not as a limitation, a HAVi-compliant host may be a set top box, a digital receiver or a PC. The HAVi-compliant host communicates with all other HAVi-compliant components that are connected to the HAVi-compliant host and with HAVi-compliant devices connected to HAVi-complaint components.

[0053] Referring to FIG. 6, a block diagram illustrating a method of conveying information about devices that a user

US 2004/0119894 A1

Jun. 24, 2004

5

desires to control with a PRC to a service provider. Configuration server **600** is connected to HAVi-compliant host **635** over cable network **625**. HAVi-compliant host **635** comprises communication software **650** and an IR port **655**. Connected to HAVi-compliant host **635** are HAVi-compliant devices **630**. While three HAVi-compliant devices **630** are illustrated, this is not meant as a limitation. Any number of HAVi-compliant devices **630** may be connected to HAVi-compliant host **635** without departing from the scope of the present invention. A HAVi-compliant PRC **680** communicates with HAVi-compliant host **635** through IR port **690**. As would be apparent to those skilled in the art of the present invention, the link between the HAVi-compliant host **635** and the HAVi-compliant PRC **680** is not limited to the IR link illustrated in **FIG. 6** but may be established by other means. By way of example and not as a limitation, this link may be a wired link or a wireless RF-link.

[0054] When the HAVi-compliant host **635** is first powered on it identifies each of the HAVi-compliant devices connected to it. The HAVi-compliant host **635** maintains a device data record **640** for each HAVi-compliant device **630** connected to it. If a new HAVi-compliant device **630** is found a device data record **640** is created for that device. Additionally, the HAVi-compliant host **635** sends a "hello" message from its IR port **655** to the IR port **690** of HAVi-compliant PRC **680**. HAVi-compliant PRC **680** answers with a response message that comprises an id value unique to the HAVi-compliant PRC **680**. The response message is generated by communication software **685**.

[0055] The HAVi-compliant host **635** sends a registration message over cable network **625** to service provider **600**. The registration message comprises the id value of the HAVi-compliant PRC **680**, the device data record **640** of each HAVi-compliant device connected to HAVi-compliant host **635**, and a MAC address of the HAVi-compliant host **635**. In one embodiment, the user obtains the HAVi-compliant host **635** from service provider. In this embodiment, the service provider maintains a user identity file on each user and associates the MAC address of the HAVi-compliant host **635** with a particular user. Based on the MAC address provided in the registration message, the service provider **600** associates the HAVi-compliant PRC and the device data record **640** with the user of the HAVi-compliant host **635** and stores the device data record **640** in a user configuration file **624**. In an alternate embodiment, the user obtains a HAVi-compliant host **635** from another source and notifies the service provider of the MAC address of the HAVi-compliant host **635** before installation of the host.

[0056] In either case, the user is automatically registered with the service provider **600**. A user configuration file **624** is created for the user and stored in data storage device **616**. The user configuration file **624** comprises user identity data **610** that associates configuration file **624** with the user and device data **615**. Additionally, data storage device **616** stores remote control instruction sets **620** for a plurality of HAVi-compliant devices from a plurality of device manufacturers.

[0057] Upon the completion of registration, service provider **600** sends a configuration message to HAVi-compliant host **635** over cable network **625**. The configuration message comprises the remote control instruction set for each HAVi-compliant device connected to HAVi-compliant host **635**. The remote control instruction set of a HAVi-compliant device is selected from a list of remote control instruction sets **620** based on the device data **615**. Upon receipt of the configuration message, HAVi-compliant host **635** stores

each received remote control instruction set in received remote control instruction set **640** and then issues a programming message to HAVi-compliant PRC **680** over the complementary IR ports **655** and **690**. The programming message comprises an installation script and remote control instruction set for each HAVi-compliant device connected to HAVi-compliant host **635**. HAVi-compliant PRC **680** executes the script and configures itself to operate the HAVi-compliant devices in accordance with the remote control instruction set. Upon completion of the configuration of each remote control instruction set, the PRC is able to directly control each remotely controllable HAVi-compliant device with the HAVi-compliant PRC.

[0058] In yet another embodiment of the present invention, the registration message is sent each time HAVi-compliant host **635** is rebooted or when a HAVi-compliant device **630** is connected to, or disconnected from, the HAVi-compliant host **635**. In this way, the user configuration file **624** is updated. In an alternate embodiment, a newly connected device is automatically added to the user configuration file **624**, but a device that has been disconnected is not removed from the configuration file **624** without first confirming with the user that removal is appropriate.

[0059] In another embodiment of the present invention, the HAVi-compliant PRC comprises a display and a plurality of buttons. In this embodiment, a remote control instruction set is implemented as virtual buttons on the display, as commands to be entered through the plurality of buttons, or by a combination of buttons and virtual buttons. In yet another embodiment, the HAVi-compliant PRC associates a particular implementation of a remote control instruction set with a user-selected display.

[0060] In still another embodiment, the devices **630**, **635**, and **680** are compliant with the IEEE 1394 protocols (which protocols comprise the A/VC protocol), but not with the HAVi protocol. The operation of this embodiment does not materially differ from the process flow illustrated in **FIG. 6**. However, without compliance with the HAVi standard, the ability of devices to communicate information among the other devices will depend on how the 1394 protocols have been implemented.

[0061] A method for programming a programmable remote control device has now been illustrated. As described herein, the method for programming a programmable remote control device simplifies the task of programming a programmable remote control as well as safeguarding the device record used to program the programmable remote control. It will be understood by those skilled in the art that the present invention may be embodied in other specific forms without departing from the scope of the invention disclosed and that the examples and embodiments described herein are in all respects illustrative and not restrictive. Those skilled in the art of the present invention will recognize that other embodiments using the concepts described herein are also possible.

What is claimed is:

1. A method for programming a programmable remote control over a network from a configuration file, wherein the network comprises a user computer and a configuration server connected via the network, the method comprising:

sending from the user computer a storage request;

receiving at the configuration server the storage request, wherein the storage request

US 2004/0119894 A1

Jun. 24, 2004

6

comprises a user identifier and one or more device identifiers each associated with a unique controllable device; and

storing in a configuration file each device identifier in association with the user identifier.

2. The method of claim 1, wherein the user computer comprises a set top box.

3. The method of claim 1, wherein each of the one or more device identifiers is uniquely associated with a television, a television receiver, an audio-video receiver, a DVD player, a VCR, and an MP3 player.

4. The method of claim 1, wherein the network is selected from a group consisting of a wireless network, a satellite network, a cable network, the public switched telephone network, and a packet switched network.

5. A method for programming a programmable remote control over a network from a configuration file, wherein the network comprises a user computer and a configuration server connected via the network, wherein the configuration server is connected to a configuration file associated with a user via a user identifier, and wherein the configuration file has stored therein one or more device identifiers each associated with a unique controllable device, the method comprising:

sending from the user computer a programming request;

receiving at the configuration server the programming request, wherein the programming request comprises the user identifier;

selecting the configuration file associated with the user identifier;

selecting a remote control instruction set associated with each device identifier stored in the configuration file;

for each device identifier stored in the configuration file, sending the selected remote control instruction set to the user computer;

receiving at the user computer each selected remote control instruction set;

communicating each selected remote control instruction set to a programmable remote control; and

programming the programmable remote control in accordance with each selected remote control instruction set.

6. The method of claim 5, wherein the user computer comprises a set top box.

7. The method of claim 5, wherein each of the one or more device identifiers is uniquely associated with a television, a television receiver, an audio-video receiver, a DVD player, a VCR, and an MP3 player.

8. The method of claim 5, wherein communicating each selected remote control instruction set to a programmable remote control comprises sending each remote control instruction set to the programmable remote control over a link between the user computer and the programmable remote control.

9. The method of claim 8, wherein the link is selected from the group consisting of an infrared link, a wireless link, and a wired link.

10. The method of claim 5, wherein the method further comprises:

receiving at the configuration server an add-new-device request from the user computer, wherein the add-new-device request comprises a user identifier and a device identifier; and

adding the device identifier of the new device to the configuration file associated with the user identifier.

11. The method of claim 5, wherein the method further comprises:

receiving at the configuration server a delete-existing-device request from the user computer, wherein the delete-existing-device request comprises a user identifier and a device identifier; and

deleting the device identifier of the existing device of the configuration file associated with the user identifier.

12. The method of claim 5, wherein the network is selected from a group consisting of a wireless network, a satellite network, a cable network, the public switched telephone network, and a packet switched network.

13. A method for programming a HAVi-compliant programmable remote control over a network from a configuration file, wherein the network comprises a HAVi-compliant host and a configuration server connected via the network, the method comprising:

sending from the HAVi-compliant host a registration message, wherein the registration message comprises the MAC address of the HAVi-compliant host and one or more device data records each associated with a HAVi-compliant device connected to the HAVi-compliant host;

receiving at the configuration server the registration message; and

storing in a configuration file the device data records, wherein the configuration file is associated with the HAVi-compliant host via the MAC address.

14. The method of claim 13, wherein the MAC address associates a user with a user identifier.

15. The method of claim 13, wherein the HAVi-compliant host comprises a set top box.

16. The method of claim 13, wherein the HAVi-compliant device comprises a HAVi-compliant programmable remote control having a programmable remote control identifier.

17. The method of claim 16, wherein the registration message further comprises the programmable remote control identifier, and wherein the method further comprises associating the device data records with the programmable remote control identifier.

18. The method of claim 13, wherein the HAVi-compliant device is selected from the group consisting of a television, a television receiver, an audio-video receiver, a DVD player, a VCR, and an MP3 player.

19. The method of claim 13, wherein the network is selected from a group consisting of a wireless network, a satellite network, a cable network, the public switched telephone network, and a packet switched network.

20. A method for programming a HAVi-compliant programmable remote control over a network from a configuration file, wherein the network comprises a HAVi-compliant host and a configuration server connected via the network, wherein the configuration server is connected to the configuration file, wherein the configuration file has stored therein a MAC address of the HAVi-compliant host,

US 2004/0119894 A1

Jun. 24, 2004

7

and wherein the MAC address is associated with a device data record of each HAVi-compliant device connected to the HAVi-compliant host, the method comprising:

sending from the HAVi-compliant host a programming message, wherein the programming message comprises the MAC address of the HAVi-compliant host;

receiving at the configuration server the programming message;

selecting the configuration file associated HAVi-compliant host;

selecting a remote control instruction set for each HAVi-compliant device for which a device data record is stored in the configuration file;

sending the selected remote control instruction set to the HAVi-compliant host;

receiving at the HAVi-compliant host each selected remote control instruction set;

communicating each selected remote control instruction set to the HAVi-compliant programmable remote control; and

programming the HAVi-compliant programmable remote control in accordance with each selected remote control instruction set.

21. The method of claim 20, wherein selecting the configuration file associated with the HAVi-compliant host comprises selecting the configuration file associated with the MAC address of the HAVi-compliant host.

22. The method of claim 20, wherein the MAC address of the HAVi-compliant host associates a user with a user identifier.

23. The method of claim 22, wherein selecting the configuration file associated with the HAVi-compliant host comprises selecting the configuration file associated with the user identifier.

24. The method of claim 20, wherein the HAVi-compliant host comprises a set top box.

25. The method of claim 20, wherein the HAVi-compliant device is selected from the group consisting of a television, a television receiver, an audio-video receiver, a DVD player, a VCR, and an MP3 player.

26. The method of claim 20, wherein the device data record of each HAVi-compliant device connected to the HAVi-compliant host is associated with the HAVi-compliant programmable remote control via a programmable remote control identifier, wherein the programming message further comprises the programmable remote control identifier, and, wherein selecting a remote control instruction set for each HAVi-compliant device for which a device data record is stored in the configuration file comprises selecting each device data record associated with the programmable remote control identifier.

27. The method of claim 20, wherein communicating each selected remote control instruction set to a HAVi-compliant programmable remote control comprises sending each remote control instruction set to the HAVi-compliant programmable remote control over a link between the HAVi-compliant host and the HAVi-compliant programmable remote control.

28. The method of claim 27, wherein the link is selected from the group consisting of an infrared link, a wireless link, and a wired link.

29. The method of claim 20, wherein the network is selected from a group consisting of a wireless network, a satellite network, a cable network, the public switched telephone network, and a packet switched network.

30. The method of claim 20, wherein the HAVi-compliant programmable remote control comprises a display having a plurality of screens, each screen comprising a plurality of programmable objects, and, wherein programming the HAVi-compliant programmable remote control in accordance with each selected remote control instruction set comprises associating a programmable instruction set with one of the plurality of screens and a programmable instruction with one of the plurality of objects of that one of the plurality of screens.

31. The method of claim 20, wherein the HAVi-compliant programmable remote control comprises a plurality of programmable keys, and, wherein programming the HAVi-compliant programmable remote control in accordance with each selected remote control instruction set comprises associating a programmable instruction with one of the plurality of programmable keys.

32. A system for programming a programmable remote control, the system comprising:

a configuration server adapted to receive a storage request from a user computer, wherein the storage request comprises a user identifier and one or more device identifiers each associated with a unique controllable device; and

a configuration file accessible to the configuration server associated with the user identifier and adapted to receive from the configuration server and store the one or more device identifiers.

33. The system of claim 32, wherein the user computer comprises a set top box.

34. The system of claim 32, wherein each of the one or more device identifiers is uniquely associated with a television, a television receiver, an audio-video receiver, a DVD player, a VCR, and an MP3 player.

35. The system of claim 32, wherein:

the configuration server is further adapted to:

receive a programming request from the user computer, wherein the programming request comprises a user identifier;

select the configuration file associated with the user identifier;

select a remote control instruction set associated with each device identifier stored in the configuration file; and

for each device identifier stored in the configuration file, send to the user computer the selected remote control instruction set; and

the user computer is adapted to:

receive each selected remote control instruction set;

communicate to a programmable remote control each selected remote control instruction set; and

US 2004/0119894 A1

Jun. 24, 2004

8

program the programmable remote control in accordance with each selected remote control instruction set.

36. The system of claim 35, wherein the user computer is further adapted to communicate each selected remote control instruction set to a programmable remote control over a link between the user computer and the programmable remote control.

37. The system of claim 36, wherein the link is selected from the group consisting of an infrared link, a wireless link, and a wired link.

38. The system of claim 35, wherein the configuration server is further adapted to:

receive an add-new-device request from the user computer, wherein the add-new-device request comprises the user identifier and a device identifier; and

add the device identifier of the new device to the configuration file associated with the user identifier.

39. The system of claim 35, wherein the configuration server is further adapted to:

receive a delete-existing-device request from the user computer, wherein the delete-existing-device request comprises the user identifier and a device identifier; and

delete the device identifier of the existing device of the configuration file associated with the user identifier.

40. A system for programming a HAVi-compliant programmable remote control, the system comprising:

a configuration server adapted to receive a registration message from a HAVi-compliant host, wherein the registration message comprises the MAC address of the HAVi-compliant host and one or more device data records each associated with a HAVi-compliant device; and

a configuration file accessible to the configuration server and adapted to receive from the configuration server the MAC address of the HAVi-compliant host and to associate with the MAC address a device data record of each HAVi-compliant device connected to the HAVi-compliant host.

41. The system of claim 40, wherein:

the configuration server is further adapted to:

receive a programming message from the HAVi-compliant host;

select the configuration file associated with the HAVi-compliant host;

select a remote control instruction set for each HAVi-compliant device for which a device data record is stored in the configuration file; and

send each selected remote control instruction set to the HAVi-compliant host; and

the HAVi-compliant host is adapted to:

receive each selected remote control instruction set;

communicate each selected remote control instruction set to a HAVi-compliant programmable remote control; and

program the HAVi-compliant programmable remote control in accordance with each selected remote control instruction set.

42. The system of claim 41, wherein selecting the configuration file associated with the HAVi-compliant host comprises selecting the configuration file associated with the MAC address of the HAVi-compliant host.

43. The system of claim 41, wherein the MAC address of the HAVi-compliant host associates a user with a user identifier.

44. The system of claim 43, wherein selecting the configuration file associated with the HAVi-compliant host comprises selecting the configuration file associated with the user identifier.

45. The system of claim 41, wherein the HAVi-compliant host is further adapted to send each remote control instruction set to the HAVi-compliant programmable remote control over a link between the HAVi-compliant host and the HAVi-compliant programmable remote control.

46. The system of claim 45, wherein the link is selected from the group consisting of an infrared link, a wireless link, and a wired link.

47. The system of claim 41, wherein the registration message further comprises a programmable remote control identifier associated with a HAVi-compliant programmable remote control and, wherein the configuration file is further adapted to associate device data records with the programmable remote control identifier.

48. The system of claim 47, wherein:

the configuration server is further adapted to:

receive a programming message from the HAVi-compliant host;

select the configuration file associated the HAVi-compliant host;

select the device data records associated with the programmable remote control identifier;

select a remote control instruction set for each HAVi-compliant device for which an device data record is stored in the configuration file; and

send each selected remote control instruction set to the HAVi-compliant host; and

the HAVi-compliant host is adapted to:

receive each selected remote control instruction set;

communicate each selected remote control instruction set to a HAVi-compliant programmable remote control; and

program the HAVi-compliant programmable remote control in accordance with each selected remote control instruction set.

49. The system of claim 48, wherein selecting the configuration file associated with the HAVi-compliant host comprises selecting the configuration file associated with the MAC address of the HAVi-compliant host.

50. The system of claim 48, wherein the MAC address of the HAVi-compliant host associates a user with a user identifier.

US 2004/0119894 A1

Jun. 24, 2004

9

51. The system of claim 50, wherein selecting the configuration file associated with the HAVi-compliant host comprises selecting the configuration file associated with the user identifier.

52. The system of claim 48, wherein the HAVi-compliant host is further adapted to send each remote control instruction set to the HAVi-compliant programmable remote control over a link between the HAVi-compliant host and the HAVi-compliant programmable remote control.

53. The system of claim 52, wherein the link is selected from the group consisting of an infrared link, a wireless link, and a wired link.

54. The system of claim 40, wherein the HAVi-compliant programmable remote control comprises a display having a plurality of screens, each screen comprising a plurality of programmable objects, and, wherein programming the HAVi-compliant programmable remote control in accordance with each selected remote control instruction set comprises associating a programmable instruction set with one of the plurality of screens and a programmable instruction with one of the plurality of objects of that one of the plurality of screens.

55. The system of claim 40, wherein the HAVi-compliant programmable remote control comprises a plurality of programmable keys, and wherein programming the HAVi-compliant programmable remote control in accordance with each selected remote control instruction set comprises associating a programmable instruction with one of the plurality of programmable keys.

56. A method for programming a HAVi-compliant programmable remote control over a network from a configuration file, wherein the network comprises a HAVi-compliant host and a configuration server connected via the network, the method comprising:

sending from the HAVi-compliant host a update message, wherein the update message comprises the MAC address of the HAVi-compliant host and one or more device data records each associated with a HAVi-compliant device connected to the HAVi-compliant host;

receiving at the configuration server the update message;

comparing the update message with the configuration file associated with the HAVi-compliant host;

determining whether each device identifier sent in the update message matches a device identifier stored in the configuration file;

if a sent device identifier does not match any stored device identifier of the configuration file, storing the sent device identifier in the configuration file in association with the user identifier.

57. The method of claim 56, wherein the update message is sent on boot-up of the HAVi-compliant host.

58. The method of claim 56, wherein the update message is sent when a HAVi-compliant device is first connected to the HAVi-compliant host.

59. A method for programming a HAVi-compliant programmable remote control over a network from a configuration file, wherein the network comprises a HAVi-compliant host and a configuration server connected via the network, the method comprising:

sending from the HAVi-compliant host a update message, wherein the update message comprises the MAC address of the HAVi-compliant host and one or more device data records each associated with a HAVi-compliant device connected to the HAVi-compliant host;

receiving at the configuration server the update message;

comparing the update message with the configuration file associated with the HAVi-compliant host;

determining whether each device identifier stored in the configuration file matches a device identifier sent in the configuration message;

if a stored device identifier does not match any sent device identifier, deleting the stored device identifier from the configuration file associated with HAVi-compliant host.

60. The method of claim 59, wherein the update message is sent on boot-up of the HAVi-compliant host.

61. The method of claim 59, wherein the update message is sent when a HAVi-compliant device connected to the HAVi-compliant host is disconnected from the HAVi-compliant host.

62. A method for programming a programmable remote control over a network from a configuration file, wherein the network comprises a user computer and a configuration server connected via the network, wherein the configuration server is connected to a configuration file associated with a user via a user identifier, and wherein the configuration file has stored therein one or more device identifiers each associated with a unique controllable device, the method comprising:

sending from the user computer a storage request;

receiving at the configuration server the storage request, wherein the storage request comprises a user identifier and one or more device identifiers each associated with a unique controllable device;

storing in a configuration file each device identifier in association with the user identifier;

sending from the user computer a programming request;

receiving at the configuration server the programming request, wherein the programming request comprises the user identifier;

selecting the configuration file associated with the user identifier;

selecting a remote control instruction set associated with each device identifier stored in the configuration file;

for each device identifier stored in the configuration file, sending the selected remote control instruction set to the user computer;

receiving at the user computer each selected remote control instruction set;

sending each remote control instruction set to the programmable remote control over a link between the user computer and the programmable remote control; and

executing at the programmable remote control each remote control instruction set.

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